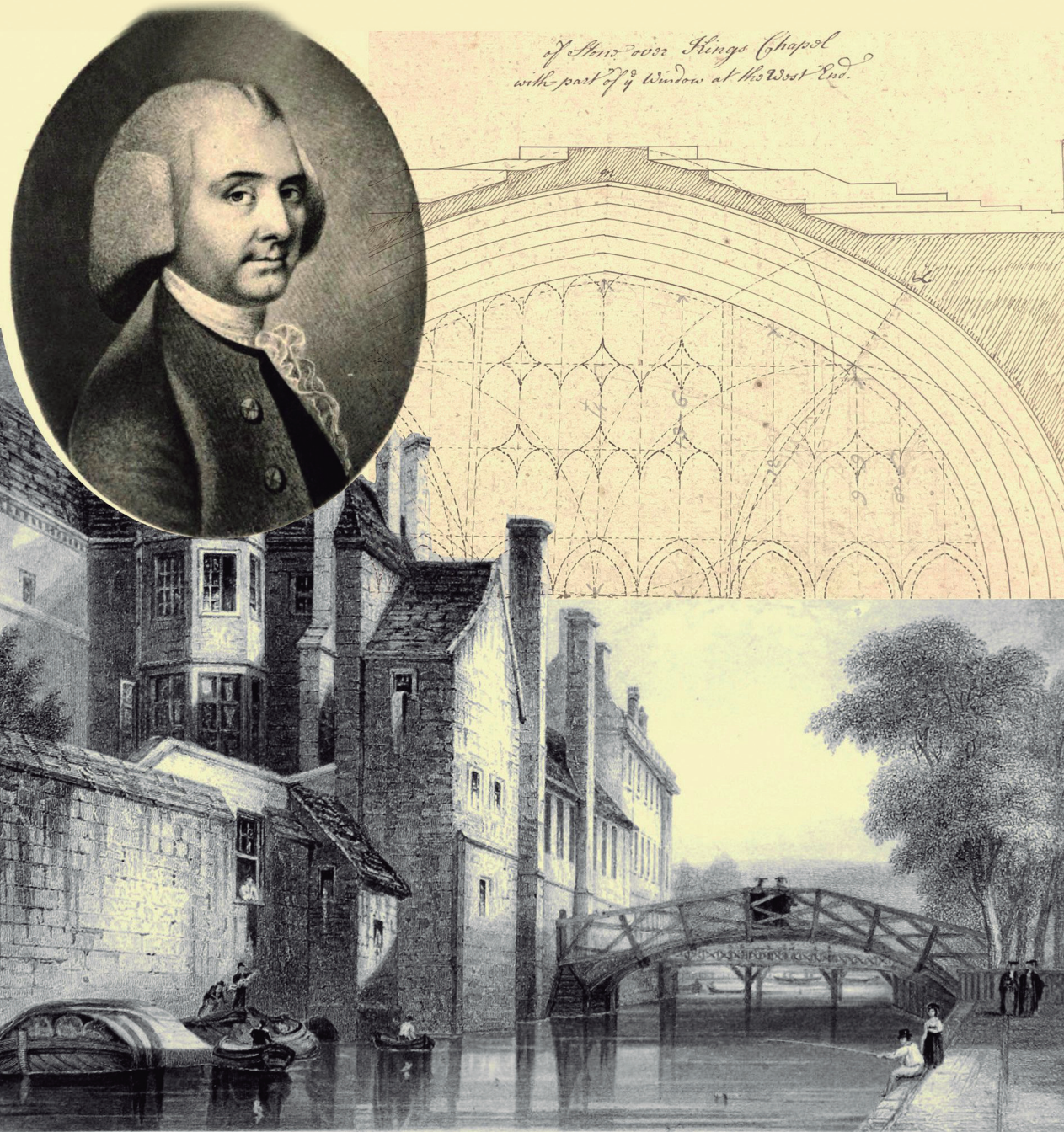
James Essex (1722-1784)
Architect and Carpenter



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Edited by
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Universidad Politécnica de Madrid

Depósito Legal: M-18502-2023
ISBN: 978-84-9728-616-9
Cubierta: Illustrations taken from: Portrait (Essex 1888); Landscape (Le Keux 1841);
Arch detail: British Library (part of BL Ass MS 6776, fol. 22)
Fotocomposición e impresión:
Gracel Asociados SLL
C/ Valgrande, 15
28018 Alcobendas
Distribución y venta: librosjuandeherrera.wordpress.com

In memory of Thomas Cocke (1949-2008)

Contents

Introduction

James W. P. Campbell

The idea for this book grew out of a symposium held in 2016 on Robert Willis, the nineteenth-century Cambridge professor, engineer and antiquarian who did so much to pioneer the study of gothic vaulting and laid the foundations for the study of engineering in the University of Cambridge. That symposium led to a book in this series: *Robert Willis: Science, Technology and Architecture in the Nineteenth century*. While researching Willis the name of one person appeared again and again as a precursor to Willis and a figure in need of further study: that person was James Essex. Thus it was decided that another symposium should be held and a new team of scholars should be brought together to produce papers and the idea for this volume was born.

Thanks to various factors and the appearance of COVID 19, the symposium and the book became delayed. The symposium was eventually held on 3rd April 2022 in Queens' College, Cambridge. It has taken the intervening time for the papers to be brought to completion and the book to print.

It is incredible to think that this is the first book to be written on James Essex (1722-84). He led a full and interesting life in Cambridge. He was never an academic in the University, but he moved in academic circles and was respected in later years as an expert on Gothic architecture, becoming a Fellow of the Society of Antiquaries and discussing the details of Gothic architecture with academics and antiquarians. He started to write several books but never finished them.

Essex was an autodidact and self-made man. His knowledge of Gothic architecture was based firmly on his experience as an architect and a builder and through that practice on an intimate knowledge of Medieval buildings which he spent his life altering and repairing. He was the son of a

builder. His father was one of the leading carpenter/joiners in Cambridge in the early eighteenth century and had created the woodwork for some of the University's finest interiors. This was a trade that Essex would continue after his father's death. Indeed, James Essex would run one of the most successful building firms in Cambridge. It was through building that as a teenager he became involved in drawing buildings for his mentor in architecture, the academic James Burrough (1691-1764). This led him to another career, as an architect. In this he was highly successful, becoming the leading architect in Cambridge in the middle of the eighteenth century and changing the physical face of the University.

It is partly because he made contributions to many areas rather than just one that Essex has so far escaped without a major monograph about him. Each aspect is interesting to a different audience. However, his architectural work is mainly Cambridge-based which has limited his appeal to architectural historians while his antiquarianism is pioneering, but because it was never published it is not well-known. Essex gets an entry in the Oxford Dictionary of National Biography by Thomas Cocke and Cocke (to whom this volume is dedicated) was preparing to write a biography of James Essex. There are relatively few articles on Essex and many of them are by Thomas Cocke. Sadly, Thomas Cocke died before he could complete the task at the age of 59. He was well-known in the architecture and history of art departments at Cambridge where he taught in the late 1980s and 1990s. Apart from Cocke's articles and chapters and two unpublished MPhil dissertations in Cambridge, remarkably little has been published on James Essex. This volume thus seeks to address this gap in the literature.

The current volume is divided into seven chapters. The first, by Dominque Lazanski, sets out the biography of Essex and provides the background to the rest. In the second chapter, James Campbell provides a detailed account of Essex's work as an architect in Cambridge. The third chapter, looks at Essex's work in carpentry restoration at Ely and Lincoln where he combined his knowledge of historic construction with his understanding of structures to repair the historic roofs. The fourth chapter, by Alex Buchanan, examines Essex's work as a pioneering cathedral archaeologist, recording and interpreting what he saw. The fifth chapter, by Jacques Heyman,

explores his role as a bridge builder, particularly in the construction of the "mathematical bridge" at Queens'. The sixth explores his final project: helping Horace Walpole produce his gothic house at Strawberry Hill. Chapter. Lastly, chapter seven by Santiago Huerta looks at Essex's antiquarian work on the study of stone vaults, an area in which he was a pioneer.

I am sure all the writers of the current volume will agree that in each of these subjects we have covered we have just scraped the surface of what there is to be said and what can be said in the time and space allotted. After his death many of his papers and drawings were passed to Thomas Kerrich (1748-1828), Fellow of Magdalene, and friend and antiquarian. Kerrich deposited them in the British Library. The collection contains hundreds of pages of tightly written notes and drawings all of which warrant more research. Most relate to unfinished books. There are also many drawings both for architectural projects and surveys of historic buildings. Some of Essex's correspondence also survives in the Bodleian Library. These, together with wills, baptisms, and letters and papers in Cambridge College and University archives relating to various building projects, are the primary sources on which historians can draw. It is hoped that the chapters in this volume will provide an introduction to the study of this fascinating figure and one on which future scholars can build.

Lastly, thanks go to all those who brought this together, the contributors and my friend and colleague Santiago Huerta who has been the driving force behind the project. I would particularly like to thank my PhD student Luka Pajovic for his help in researching drawings in Cambridge collections for Chapter 2 and the Seear Fund at Queens' College, Cambridge, founded in memory of Thelma Seear, for helping to support this book financially.

James W. P. Campbell

August 2024

The Life of James Essex (1722-1784)

Dominique Lazanski

> …[H]e knowing more of Gothic Architecture than any one I have heard talk of it; & by his works of this Sort, will convince the world, that many People who have wrote on the Subject are but Dabblers in the science, & know not what they are about. (British Library Add MS 5842 f164)

Reverend William Cole, writing in one of his commonplace books on January 2, 1771, captured the essence of James Essex and of his life's work. Essex is now a little-known architect and antiquarian, but during his lifetime he was a prolific antiquarian who had a busy architectural practice and an active intellectual life, although his major work on the Gothic style remains unpublished. Involved in a circle of Cambridge antiquarians, including Reverend Cole, he was well-liked and well-known among the antiquarians of his day and in the Society of Antiquaries of which he was a member. His reputation preceded him, and later in life, he was commissioned to survey Ely and Lincoln Cathedrals and undertake repairs at both. He combined his intellectual life and studies on Gothic Architecture with his work and was a keen observer of much antique architecture in situ. It is his first-person observations, combined with the primary and secondary research that he undertook which makes his study of, and writing on the Gothic, influential during his time, as Rev. Cole notes.

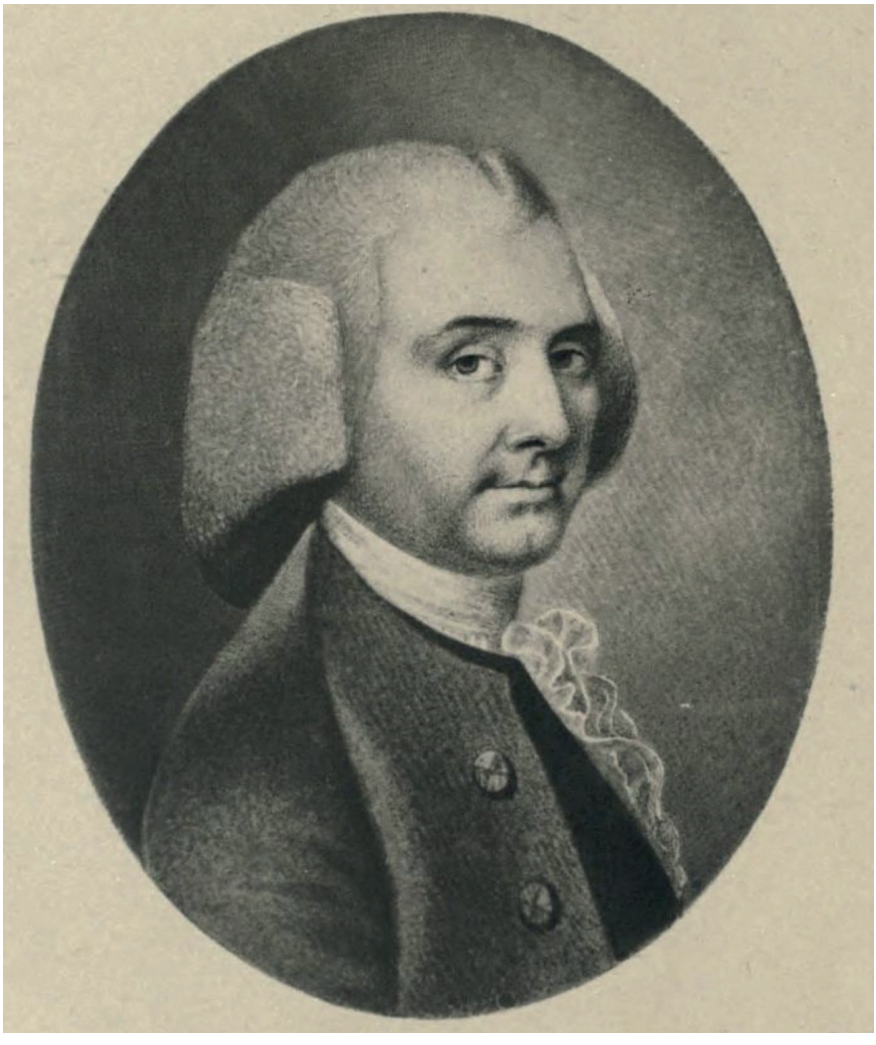

Figure 1
Portrait of James Essex

James Essex (1722-1784) (Fig. 1) was born in Cambridge and is best known as a Cambridge architect. He was associated with several of the major local architectural commissions during his lifetime. He rose in status from an artisan and joiner to become an architect and antiquarian. In his later life, the study of ancient buildings became the focus of his work.

His unpublished book, *History of Gothic Architecture*, became the focus of his research later in life but remains incomplete.[1] Essex was a prolific researcher, note taker, and information gatherer. He took great pains to find the physical and structural reasons behind the development of the style which characterised Gothic architecture, and its most important element, the pointed arch. Through deductive reasoning, he argued for an evolution of architectural style with the mindset of a practical engineer. On a number of occasions, he stated in a matter-of-fact way that,

> These (divine) proportions, and the principles on which they are founded (though little regarded), may be traced back to (ye) remotest Ages of Antiquity, from thence proceeded every regular system of Architecture, the Egyptian first; afterward the Greek, and Roman, and from these the Gothic . . . (British Library Add MS 6760 f. 9r)

Essex published several papers in his lifetime based on his research and developed coherent theories on stone and brick buildings, the origins of the pointed arch, and the history and theory of vaults and vaulting. Essex died intestate in 1784, but his books, notes and papers ended up in the custody of his godson Thomas Kerrich (1748-1828), who was also married to Essex's niece. In turn, Kerrich left his own notes as well as those of James Essex to the British Museum. Thomas Kerrich's collection is British Library MS ADD 6728-76. James Essex's manuscripts are British Library MS ADD 6760-73 and 6776. In total, the British Library has fifteen volumes of Essex's notes, not including published works. His journal of a tour through part of Flanders and France, his only foreign trip, has been published also, although the original manuscript is now lost (Fawcett [1773] 1888).

James Essex has been the source of a 1984 exhibition, several chapters in books and a few magazine articles. He is cited in several PhD dissertations on approaches to English Gothic architecture. His work as an architect was first researched in a 1949 Cambridge thesis by D.R. Stewart. Which formed the basis of his article 'James Essex', published in the *Architectural Review* in 1950. Some of the most extensive research on Essex so far can be found in an 1977 undergraduate dissertation from Cambridge by Yvonne Jerrold that is unpublished. In it, the methodological and historical context for James Essex's interest is explored. Thomas Cocke produced several insightful essays including a paper in his work in cathedral restoration in 1974; and biographical accounts 'James Essex 1722-1784', in *The Architectural Outsiders* (1985) and *The Ingenious Mr. Essex, Architect*, a small catalogue for an exhibition at the Fitzwilliam Museum (1984). Essex's interest in Medieval architecture has been discussed in PhD dissertations (see Horsfall Turner 2009 and Buchanan 2013). One of the shortest, but most insightful works on James

Essex is a chapter by Nikolaus Pevsner in his book 19th-century architectural writers (1972). Pevsner describes the foundation that Essex lays in the context of the rise of the Gothic revival from an architectural point of view, and how he accounted for that through his research approach (Pevsner 1972).

While James Essex has been featured in numerous articles and texts pertaining to the history of architecture and English antiquarians, there has been a notable absence of in-depth investigations into his life and work. Given his interesting personal and professional journey, a more comprehensive exploration is warranted. Examining his background and biography serves as a solid foundation for a start.

Early Life

James Essex was born in 1722 in Cambridge, to Bridget and James Essex, joiner, carpenter and builder. He was sent to the grammar school attached to Kings College and was later apprenticed to Sir James Burroughs (1691-1764) to study architecture (Stewart 1950). Burroughs became his mentor and patron throughout most of his life and Essex's archives show that they had constant interaction during his lifetime. In BL ADD MS 6768 f. 252 Essex has noted down a description of Wisbech steeple from a letter written by James Borroughs to M. Dalton. The papers in this manuscript are from 1778 which suggests that Essex had access to Borroughs' papers even after his death in 1764.

Essex married Elizabeth Thurlbourn in 1753 and they had a son, James, who died before the age of three, and a daughter, Millicent, who went on to marry John Hammond, a fellow at Queens' College (Cocke 1985, 105)

Throughout his lifetime, Essex had a successful career as a builder and joiner, and later a consulting architect. His school years were spent so close to Kings College Chapel that its magnificence may well have helped inspire his lifelong interest in Gothic architecture (Cocke 1984, 3). In 1737, at the age of 15, he drafted a drawing of the Norman Chapel at Barnwell, later incorporated into a map of Stourbridge Fair (BL Add MS 6767 ff26-27). By 1740, he had plans to publish a book on *The Antiquities of Cambridge*, showing his early interest in architectural history and antiquities (BL Add MS 6770). Following his education, he joined the family firm and took over from his father at the age of 27, when his father died. It was around this time that Essex received apprenticeship training from Sir James Burroughs who promoted Essex as an architect in addition to his building practice. It is this ongoing relationship that allowed him to increase his social status, a point we will come back to later with respect to antiquarian research.

Figure 2
View of the Mathematical Bridge with the Essex Building behind, Queens' College, Cambridge (Photograph by James Campbell)

Essex spent the 1750s and 1760s developing his work and increasing his status and reputation through his family firm, and in conjunction with Burroughs. In 1759 he was commissioned to build a new range for Queens' College along the river. Only the southern part of that building was finished, but because of the lightness of the rooms, they were much admired. Additionally, during this time, he worked on updating the Jacobean ranges of Neville's Court, Trinity College and building a new chapel and ante-chapel for Clare College 1764-9 to Burroughs' basic design, before Burroughs' death. He worked on the construction of the 'mathematical' bridge at Queens' (Fig. 2) and later designed the Cycloidal Bridge at Trinity College, which, unlike several other of his works around Cambridge, is still standing. He was also responsible for, among many projects, the re-facing of the First Court at Christ's College, the refashioning of the Queen's Chapel and the building of a new chapel and library at Sidney Sussex, all at Cambridge. By the 1770s, in the last decade and a half of his life, he was undertaking the restoration of Kings College Chapel (Doig 1978) including the design and building of an altarpiece, as well as many other projects including work at several cathedrals. At the time of his death in 1784, his estate was worth £20,000 (Cocke 1985: 104).

James Essex's work in the 1770s at the Cathedrals of Winchester, Ely and Lincoln was, in many ways, the high point of his architectural career, and from this work, we can see the crossover with his interest in antiquarianism and the Gothic. This work also had an impact on his life in two ways. It advanced his social standing as a gentlemen architect and bearer of architectural knowledge beyond his career as a joiner and surveyor, and it also advanced his work as an architectural antiquarian. The combination of his architectural and mechanical knowledge, along with his historical knowledge and his personal experience and observations of ancient architecture, were put into practice at these cathedrals.

In 1757 Essex made a complete survey of Ely Cathedral and carried out extensive, and controversial, repairs. His work lasted five years, and during that time he undertook structural repairs to the East end and rebuilt much of the lantern and octagon. The major focus of his work, however, was moving the choir to the East end of the Cathedral. It was installed with new reredos and an organ screen, both to Essex's design. Though some lament the changes made to the medieval fabric, Essex left us with drawings of the original choir and decorations (Cocke 1975; see BL Add MSS 6764, 6768, 6772). The Reverend Cole transcribed Essex's survey and a letter from Essex to the Dean of Ely concerning the removal of the choir dated June 14 1759 in commonplace book (BL Add MS 5842 ff.170r-173r). This work came about because of Essex's friendship with James Bentham, a prebendal at Ely and part of the Cambridge antiquarian group Essex frequented. When *The History and Antiquities of the Conventual and Ca-*

thedral Church of Ely was published in 1771 and written by Bentham, the influence was clear. The lasting friendship of these two men evidently informed Bentham's attempt to describe architectural style by observation and critical thinking (Frew 1980). James Bentham's work on dating and defining style was as important as Essex's and yet less refined. However, taken together both Essex and Bentham made clear strides in stylistic attribution of architecture during the 18th century.

At Lincoln, Essex first conducted a survey in 1761 and then again in 1764 (See Rev. Cole's commonplace book in which he has transcribed Essex's 1761 and 1764 survey, BL Add MSS 5842 f164r-167v and f168v-168v). His focus in the initial survey was to locate any immediate damage and needed repairs. He looked primarily at the vaulting and roofs and noted that much of the damage was done by previous careless workmen (Cock 1975, 16). His survey three years later indicated that much of the work he proposed in 1761 had not been undertaken and that too much iron was in the roof timbers, while too much damp continued to penetrate the Cathedral itself. He suggested that earth be dug away from the foundations, arches be placed in between the buttresses, and air holes inserted to prevent further decay from damp, which seems to have been successfully executed. Essex would undertake two additional works on the fabric in the 1770s: the refashioning of the Western screen wall and the restoration of the West Front. As noted by Essex in his surveys, both suffered from structural and aesthetic faults, but only the work on the Western screen wall was complete by his death in 1782 (Cocke 1975, 17). In addition to his structural surveys and work at Lincoln, Essex undertook two other projects. First, in 1768 the 17th-century wainscoting was removed to reveal the medieval stonework, and Essex was asked to make the new rendition of the wall more attractive. His result was a remodelling of the screen with blind arcading, the addition of wings to the reredos and the mounting of the altar in keeping with the contemporary style with triple gables (Cocke 1975, 17)(British Library Add MS 6772 f 282r-v). He also undertook the creation and erection of the Bishop's throne nearly ten years later.

Essex's work on Ely and Lincoln led to work at other Cathedrals further afield. His proven reputation allowed him to prevent the attempted erection of a central spire at Lincoln, which wouldn't have been structurally possible due to the lack of any foundational support. Because of his mathematical and systematic approach, Essex was respected enough for his voice to carry weight when the Dean of Lincoln, James Yorke, came up with the central spire proposal (Cocke 1975).

Essex's work at Lincoln, unlike Ely, led to the reading of a paper entitled *Some Observations on Lincoln Cathedral* at the Society of Antiquaries on March 16, 1775. The paper was a marriage of his business work in practice and

his intellectual work in theory. It was subsequently published in the Society's journal, *Archaeologia*, in 1776 (Essex 1776). This paper epitomises the qualities that James Essex possessed and the application of his methodologies seen throughout his research during his life. He combined first-hand observation with reading and research, and with a surveyor's eye. Essex refuted assertions made in previous publications because they do not adhere to basic building techniques and the mechanics involved. And he took a practical approach to studying Lincoln Cathedral when discussing his work and research about the Cathedral. He used previously published sources, as well as his own observations, to elucidate the original plan of the Cathedral by comparing them to the fabric of the church. He states:

> ... I have endeavoured to trace them, by comparing the historical accounts with the fabric itself; and from various opportunities I have had of examining several parts of the church, and comparing them with the plans in Sir William Dugdale's and Mr. Willis' histories, I have been able to delineate one which will give a perfect idea of the original form and extent of this Cathedral, and explain several alterations and additions that have been made to it at different times (Essex 1776)

Throughout his life, James Essex planned to write a *History of Gothic.* The structure and content of the book evolved over several decades and changed many times. In 1756, Essex proposed a "proper Account" of the Royal Chapel of King's College, Cambridge. The printed proposal from October 1 of that year states that the final publication would include fifteen plates, a description of the design of the building along with a history and "comparisons made with other Buildings in the Gothick Stile."(British Library ADD MS 6772 f5r) This is the first mention of such an undertaking in his life. As late as 1771, Horace Walpole was still hoping that some version of this proposed publication would take place, but the book was never published, although drawings in preparation for prints to be published along with the history exist in the Essex archive. (Lewis, 1937, Vol. I pp. 211-212)

In addition to his work and research, James Essex engaged closely with a group of medievalists in Cambridge who were interested in history and had an academic background. Cambridge was the centre of this scholarly community in the 18th century, and Essex's association with this wider group of men no doubt led to his election as a fellow to the Royal Academy of Antiquaries in 1772 (Cocke 1975). With William Cole (1714-1782) at the core of the group, Cole and Essex became close friends and they exchanged letters and engaged in antiquarian discussions. Cole loaned Essex books and manuscripts to further his knowledge, and Cole transcribed a number of documents and letters by Essex (Cocke 1985).

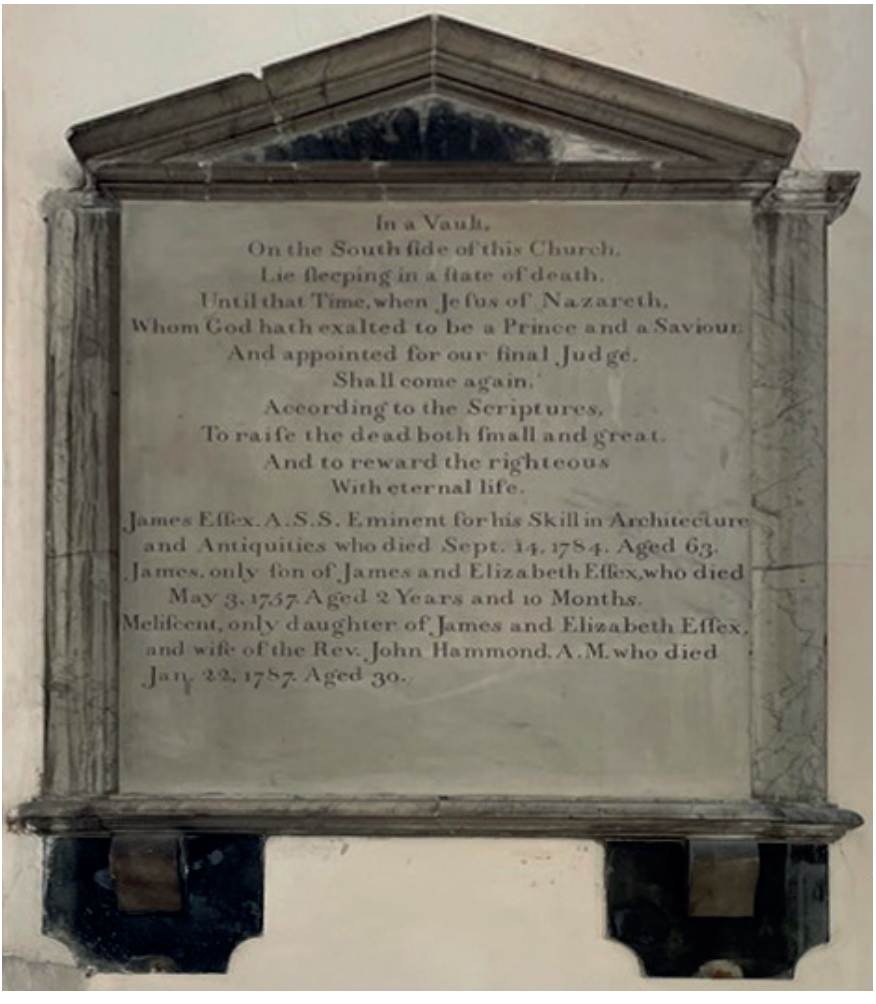

Figure 3
Memorial to James Essex, North Aisle, St Botolph's Church, Cambridge (Photograph by Dominique Lazanski)

Essex had such a significant relationship with Cole, that Cole copied a number of Essex's papers and texts into his own commonplace books. Cole was a great compiler in the humanist tradition of keeping copies of documents, texts, letters and notes which he accurately describes, and footnotes with his own comments on what condition they were in, the handwriting and how accurately he copied and compiled them with his own work. Though Cole's copying du-

plicates Essex's own notes and letters, there was a possibility of losing Essex's work at the time, for there was no guarantee that the notes would survive or even be published.

Cole also introduced Essex to Horace Walpole (1717-1797). As a result of that introduction, Essex designed a room for Walpole at Strawberry Hill. Another antiquarian, Michael Tyson (1740-1780) was to work with both James Essex and Horace Walpole to produce a massive history of Gothic (1937). Essex joined Tyson on a tour in Flanders in 1773, and Essex's diary of that tour was published by the Cambridge Antiquarian Society in 1888 (Fawcett 1888). Through Tyson, Essex was introduced to another Cambridge antiquarian, Richard Gough (1735-1809). Gough asked Essex for advice on the reconstruction of a timber bridge at Rochester and it is likely through Gough that Essex was elected as a Fellow of the Society of Antiquaries (Cocke 1984).

James Essex died of a stroke on 14 September 1784 at the age of 61 after losing his mother in May of that year. He was buried in St Botolph's churchyard, Cambridge (Fig. 3). He remained active towards the end of his life and as late as 1782, he rebuilt the Cambridge Guildhall. However, his notes and writings on the *History of Gothic Architecture* remained unpublished at the time of his death. Thomas Kerrich, his godson, took on the responsibility of assembling the scattered and loose notes that James Essex left behind. These continue to provide invaluable insight into medieval architecture that he researched and recorded during his lifetime. Ultimately, Kerrich left the archive to the British Library, ensuring that his knowledge would be preserved for generations to come.

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Essex and Architecture: Classicising Cambridge

James W.P. Campbell

Despite the large number of works he carried out, the effect that James Essex had on the architecture of Cambridge generally goes unnoticed today. His rise from builder's son to a respected figure in the town has already been discussed in chapter one. As has already been mentioned, the key figure in this transformation was his friend and mentor James Burrough (1691-1764). As this chapter will show, in the eighteenth century, Burrough and Essex between them profoundly transformed the appearance of many of the Cambridge colleges, creating a form of architecture that became so accepted, it is now taken almost entirely for granted.

Sir James Burrough (1691-1764) was, as far as we know, the first Cambridge academic to dabble in architecture (Willis, R. and J.W. Clark. [1886] 1988. [1886] 1988, iii 536-540; Watkin 2004; Colvin 2008, 196-197). The most famous example in Oxford was Sir Christopher Wren (1632-1723), Fellow of All Souls and Savilian Professor of Astronomy in the seventeenth century, but Wren eventually left academia to devote himself entirely to architectural practice. As Willis and Clark and Colvin have all pointed out, Burrough is more directly comparable with Henry Aldrich (1648-1710) and George Clarke (1663-1736), who were two early eighteenth-century Oxford dons who acted as architects but whose main employment remained within the University (Willis and Clark [1886] 1988, iii: 536; Colvin 2008, 196). They were not exact contemporaries: Aldrich was 15 years older than Clarke and Clarke was 28 years older than Burrough. We have drawings by Aldrich and Clarke, but none have been identified with any certainty for Burrough. All three used others to draw for them and help execute their works. Of the three, Burrough has more works that can be attributed directly to

him. While Clarke and Aldrich were the sons of powerful well-connected men, Burrough was the son of a physician from Bury St Edmunds. (Colvin 2008, 196).

Burrough's degree in the eighteenth century was primarily in Classics. Having passed his MA in 1716 he was made a Fellow of his college (Gonville and Caius). He spent the rest of his life there, acting in turn as Tutor, Bursar, and finally from 1754 as Master (Watkin 2004). In this period Fellowships had to be relinquished on marriage and Burrough remained a bachelor throughout his life (Searby 1997, 102-103). His career was based entirely around the University and the connections he made through it. The same could be said for his architecture, where he seems to have become widely consulted in the University when designs were required. The first instance was in 1721 when Burrough became one of the syndics for the building of the new Senate House, drawing up a sketch which was then given to James Gibbs who worked up the scheme we see today (Willis and Clark [1886] 1988, iii: 67; Salmon 2022).

In 1727, perhaps as a reward for his involvement in the Senate House project, Burrough was appointed Esquire Bedell. This role involved organising University ceremonial and acting as a mace bearer in University processions (Stokes 2009, 19-24). As bursar of his college, he was responsible for the design of the dome and lantern over the Combination Room (Cocke 1985, 101, fig. 82, 201 n.8; Willis and Clark [1886] 1988, iii: 537). There followed a string of commissions to help with advice and designs for various colleges and works elsewhere. These were easily combined with his college duties and the relatively slight responsibilities of the post of Esquire Bedell and the college provided him with a place to live and his primary income. In time he became one of the most senior Fellows and he was duly elected Master in 1754 (Watkin 2004). Burrough managed ten years in that role before the ill health that came with a lack of exercise and being severely over-weight finally overtook him at the age of 73 in 1764:

> Sir James departed his life on Tuesday, August the 7th, about 5 o'clock in the afternoon. From the first of his illness, there were little of no hopes of recovery: yet he himself seem'd insensible of the least danger: during the whole time he was in tolerable good spirits as usual about affairs of the College, and particularly about Repairs which were then in hand. The very Tuesday on which he died, Mr Essex (the builder) was with him after dinner for half an hour, talking on that business. (Willis and Clark [1886] 1988: iii: 340)

Burrough seems to have left no publications of note behind, but from this description we can see that he was indispensable to the University: he served in very useful roles, as Esquire Bedell, as Bursar and then as Master of his college, and (because the position rotated amongst the heads of colleges) even a year in

1759 as the office of Vice Chancellor of the University. Moreover, while publishing may not have been his forte, he was certainly learned, being renowned for his collections of pictures, books, prints and medals, and at his death he left his collection of Greek and Roman coins to his college (Watkin 2004). He would probably have been surprised to learn that today he is chiefly remembered for his architectural work.

Burrough was 30 years older than James Essex. The first documented evidence of of their collaboration is a drawing by Essex for the South-East front of Peterhouse in 1738 (BL Add.Mss. 42569). At this point Essex is just 16 years old and taking this into account it is extraordinarily impressive in its competence. Who taught Essex to draw this well? Was it Burrough? As previously mentioned, we have no surviving drawings by Burrough (Colvin 2008, 197; Watkin 2004). We thus do not know how well he could draw. James Essex meanwhile had been brought up in a family of builders, no doubt surrounded by architectural drawings from an early age. Perhaps his father had taught him to draw, or perhaps Burrough had instructed him in the art, or perhaps he taught himself: we may never know for sure. What is clear is that Burrough had the work and the connections, and that Essex was a willing pupil and assistant. From 1738 onwards Burrough seems to have used Essex to do most his drawing work. Throughout this period Essex remained very much involved his family's firm and when his father died in 1749, he took over running it.

James Essex's architectural career in Cambridge is initially working for and in collaboration with James Burrough and much of his own later work would be carried on in Burrough's style. All Burrough's work in Cambridge after 1738 seems to have been done using Essex as his assistant. Thus we see them working together in Peterhouse and there are surviving drawings in Essex's hand relating to Burrough's refacing of Trinity Hall (Willis and Clark [1886] 1988, i: 229). We know that Essex was responsible for the drawings for the Doctors' Gallery in Great St Mary's and we can guess that he might have been involved in Burrough's work on Trinity Hall (1742-43), Sidney Sussex (1749-52) and presumably the ashlaring of Gonville Court at Gonville and Caius (1751-54), where Burrough was Master (Colvin 2008, 196-197). Burrough's work in these colleges followed a familiar pattern which Essex was to emulate, which involved repairing and refacing Medieval buildings in ashlar and is likely that Burrough involved Essex in the production of any drawings that might have been required. One such drawing for an unbuilt scheme survives for Trinity Hall (Trinity Hall Ms THAR/4/1/2/3/1). It shows an open-ended three-sided courtyard (which would become common theme in Essex's college work), opening out onto the river built behind the existing court which can be seen in the background which fronted onto the street.

First Independent Commissions: Corpus Christi and Queens' Wooden Bridge

The first record of we have of Essex working on a design on his own is the scheme he did in 1747 (BL Add.Mss. 42569) for the Bursar of Corpus Christi, the Rev. Robert Masters (fig.1). When the Bursar published a set of plans based on Essex's designs in 1748 (fig.2) Essex launched a campaign to prove that the design was his (Country Life, 17 October 1931, 425; Willis and Clark [1886] 1988, i: 298-299; Colvin 2008, 363). In 1748-49 he published pamphlet and engraving staking his claim (Essex 1748-9).

A comparison of the two designs shows why Essex was so concerned. Masters's design differs only in very minor ways and indeed Essex is keen to point these out as being flaws in design from someone who did not know what they were doing. Essex published a later revised scheme in 1770 in which he put the Master's Lodge at the centre, but in this early scheme and in the engraving by published by Robert Masters the chapel is in the centre.

The episode is thus not as simple as it first appears. Essex's bravery in defending himself so publicly risked offending the academic community on which his career so obviously depended. He even thanks Masters for bringing his design to the public (Essex 1748-9, 4) so he clearly understood the importance of publicity in promoting his ability. Nevertheless the episode reveals a proud and determined side to Essex's character at this early stage in his career.

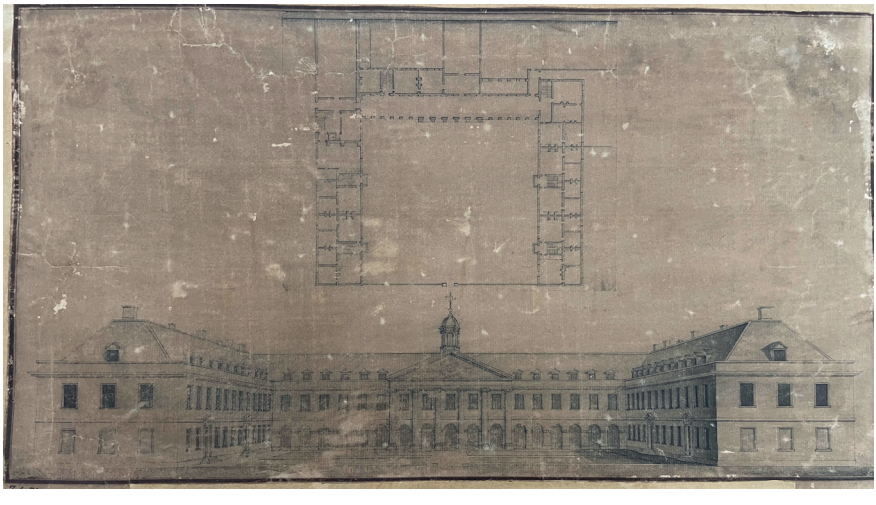

Figure 1
Essex's design for Corpus Christi College (BL Add MS Mss. 42569 f.3r).

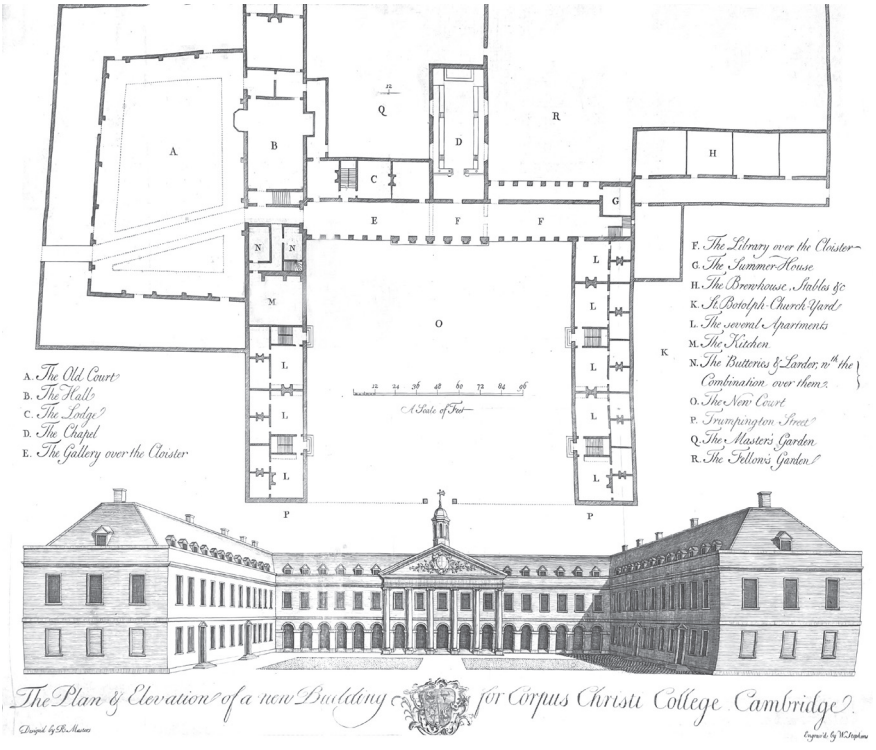

Figure 2
Engraving of proposed Design for New Court for Corpus Christi published by Robert Masters, Bursar of Corpus Christi in 1748. It was this engraving that prompted Essex to accuse Masters of stealing his design.

While the Corpus Christi affair was unfolding, Essex's father died and the younger Essex took over the family business. He was 27 years old (Cocke 1984, 3). He completed his father's existing building contracts which included the construction of wooden bridge at Queens' in 1750 which had been designed by William Etheridge (Fig. 3) in 1749 (Colvin 2008, 365; Willis and Clark [1886] 1988, ii 56). While Etheridge was an experienced bridge designer and carpenter, it was probably Essex's first commission in this field (Colvin 2008, 365; Skempton 2002, 217-218). He would go on to design and build a series of bridges over the river Cam in the following decades (see below).

Figure 3
View of Queens' College from the river (Le Keux 1841)

The First Five Years 1750-1755: University Library, Doctors' Gallery, Neville's Court

After his father's death, Essex continued to act as a carpentry contractor but we also see him starting to establish himself as an architect in his own right with four commissions: the new Manuscripts room for the University Library (1750-51), the Great Bridge across the Cam (1754), the Doctors' Gallery in Great St Mary's (1754) and the rebuilding of Neville's Court at Trinity (1755). The Great Bridge will be treated alongside his other bridges at the end of this chapter. The buildings will be examined in chronological order in five year periods.

The University Library Manuscripts Room 1750-51

The first built work whose design we can confidently ascribe to Essex alone is the dome for the Manuscripts Room in the University Library. At this time the University Library was housed in the complex buildings now called the Old

Figure 4
Thomas Rowlandson (1756–1827), 'Inside view of the Public Library, Cambridge' (1809). The domed room in the background is probably Essex's manuscript room

Schools. Essex's father had been employed remodelling the West Range of Cobble Court (Bradley and Pevsner 2014, 245). His son was hired in 1750-51 to create a dome and lantern (Fig. 4) over the room built to house the manuscripts of Bishop Moore of Ely, which George I had bought and donated to the University (Bradley and Pevsner 2014, 256). This library consisted of some 29,000 books and some 1790 manuscripts. The papers relating to the purchase are still in the University archives. The spaces in these buildings have been remodelled many times and Essex's first-floor domed room now serves as the Vice Chancellor's office. It has been extensively remodelled and only the surrounding stuccowork remains. The dome and lantern have long-since been removed but its form can be seen in a cartoon by Rowlandson (Fig. 4).

Doctors' Gallery in Great St Mary's (1754)

Great St Mary's in Cambridge acted not only as the University church but also as a court and as the setting for the disputations which were an essential part of the taking of degrees. The Medieval church had been rebuilt on the site of an earlier one between 1478 and 1519. Galleries over the side aisles had already been added in 1736 by James Gibbs. Essex was responsible for constructing a new Doctors' Gallery facing West over the chancel, demolishing the chancel screen that

Figure 5
View of the Doctor's Gallery in 1841 with the altar visible underrneath (Le Keux 1841, 3: 315)

had been added in 1640. This was known rather rudely as the Throne or Golgotha because of the dominant position of the chair in its centre. The strange arrangement (which effectively concealed the altar from view) can be seen in a nineteenth-century print by Le Keux (Fig. 5). It is indicative of how the University functions dominated the building even after the completion of the Senate

House in 1730 (Colvin, 363; VCH 1959, 131). The gallery was removed in 1863 (Colvin, 363; VCH 1959 131).

The extent to which Essex was responsible for the design of the Doctor's gallery rather than just the construction is unclear, the design normally being attributed to Burrough with Essex being cited as the builder (VCH 1959, 131). The design involved filling in the chancel with a Georgian panelled gallery over three identical semi-circular arches and inserting a segmental plaster barrel vault below the gothic vault. Essex continued to be involved with minor works at Great St Mary's throughout his career. He was paid for altering the aisle windows in 1766 and 1776, cleared houses at the West end and made good the front in 1768, repaired the tower in 1777 and renewed the roof in 1782/83 (Cocke 1984, 13).

The Rebuilding of Neville's Court at Trinity (1755)

The design of Neville's Court (Fig. 6) is more directly attributable to Essex than the Doctors' Gallery. The ranges on either side of Neville's Court had

Figure 6
Strorer's 1834 engraving of the cloister of Neville's Court in Trinity completely rebuilt by Essex in 1755. The elevation can be seen in the background as it joins the Wren Library

been extended by Christopher Wren when he constructed the new library for Trinity in the late seventeenth century (Neild 2014; Neild 2015). By the middle of the eighteenth century both the older parts and Wren's newer work were in a parlous state. It is easily assumed that Essex was just simply refacing the courts, but from the accounts, it is clear that the ranges were completely dismantled and entirely rebuilt, panelling being salvaged from the original rooms and reinstalled in the new ones (Neild 2014, 71). Essex's drawings for the façades survive. The result was a much stronger building that complements the library better than the originals, but as drawings in Robert Neild's papers show, he still retained many features that were there before. Thus in these first five years we find Essex beginning to be more involved in design but still acting mainly as a contractor.

1755-1759 New Buildings for Old Colleges: Queens' College, St Catharine's, Christs

The years 1755-1759 see Essex's architectural work steadily increasing and his own hand becoming more readily apparent. The most striking schemes are for two colleges: Queens' and St Catharine's.

New Range for Queens' College 1756-1760

The Medieval ranges of Queens' College had been built between 1448 and 1465 of clunch faced with brick. The facing had worked remarkably well and the Old Court did not require the refacing work that many other courts in Cambridge suffered under Burrough and Essex. Only the exposed window surrounds were replaced and those at an unknown date or dates. A smaller court on the river, called Erasmus Court or Pump Court, built in 1564 may not have been faced in brick (Willis and Clark [1886] 1988, ii: 18-19). It certainly seems to have fared less well. An account by the President Dr Robert Plumptre (Pres. 1760-77) quoted in Willis and Clark records Essex's involvement:

> In the year 1756 the Clunch Building extending from the Lodge to Staircase by the Town-Bridge to the College Kitchen, on the outside, and forming nearly two sides of the Court called Erasmus's Court within, being much decay'd was taken down, and the present useful and ornamental building begun in its place. It was planned and executed by Mr Essex an eminent Architect and man of good understanding and character in Cambridge; and was finish'd (except the fitting up of the Rooms) before the death of Mr Sedgwick in 1760. Towards defraying the expense of it, he had advanc'd £1000 on the condition

Figure7
View of Queens' College, Essex Building from across the river (Harraden 1809)

> of receiving an Annuity for life from the College, about a year and half before his death." Transcription from a manuscript history of the college by Plumptre (Willis and Clark [1886] 1988, ii: 18).

Although Plumptre's account does not mention it, Essex's building remained unfinished (Fig. 7). The design suggests the intention of demolishing the whole river facade and extending a range across this front. Only the corner staircase was built. A drawing does survive showing the whole scheme (Fig. 8). This was drawn by J. Heins Junior and engraved by P.S. Lamborn for inclusion in William Thurlbourn's *Cantabrigia Depicta*. Thurlbourn was James Essex's father-in-law. We can thus presume that the elevation in question was drawn from an original by Essex, now lost, or on his instruction. The lack of completion of the building and the fact that it was faced in buff brick rather than stone can be attributed to the poor state of the College finances at the time.

Internally Essex's Queens' building is unremarkable. The rooms are large and panelled but the staircase lacks any decoration and, while it is certainly spacious, it is distinctly utilitarian, with no cornices, panelling or other orna-

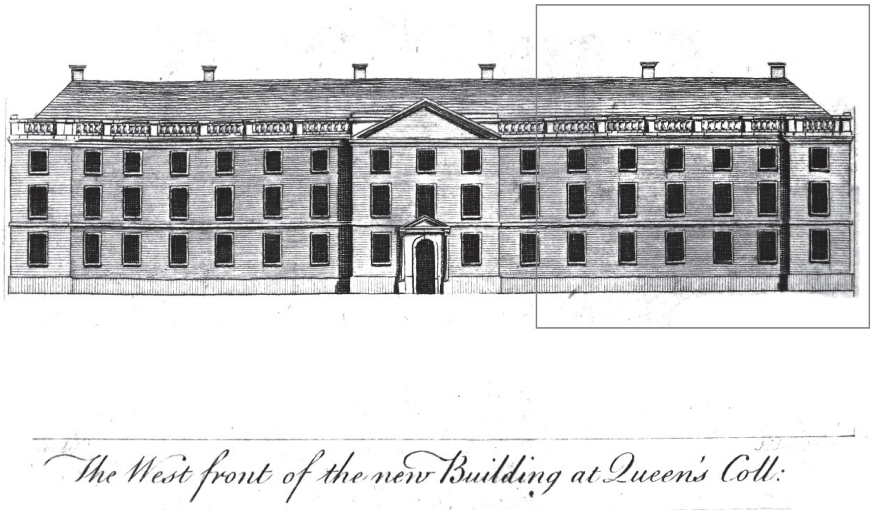

Figure 8
Proposed Complete elevation of the new building at Queens' College, drawn by J.Heins Junior and engraved by P.S. Lamborn for inclusion in William Thurlbourn's *Cantabrigia Depicta,* 1763. The box (not on original engraving) indicates the portion actually built

mentation. The rooms are panelled and less austere. The second floor has low ceilings. There is nothing to mark this out as a particularly well-designed building. Indeed, it is internally and externally, rather disappointing. One cannot help thinking that is just as well that the whole range was not completed and that much of the Medieval river range of the President's Lodge, with its fine interiors, was preserved.

Nevertheless, as Plumptre's account shows, the Fellows of Queens' College were obviously very happy with their architect and to this day the building is named after him, being called simply "the Essex building". The college invited him back in 1773-75 to remodel the chapel (all his work was removed in 1845-61) and he may have been responsible for the extensive 18th century panelling in Walnut Tree and Old Court. The extent of his involvement in that work is unknown, but he certainly fitted out some rooms "over the butteries" in 1779 (Cocke 1984, 11).

Ramsden Building and Library, St Catharine's (1757-1772)

Essex's new Queens' building had largely ignored its Medieval context in terms of materials, plan and elevation. In contrast, the Ramsden Building at St Catharine's went out its way to blend in, carefully copying the materials, scale and

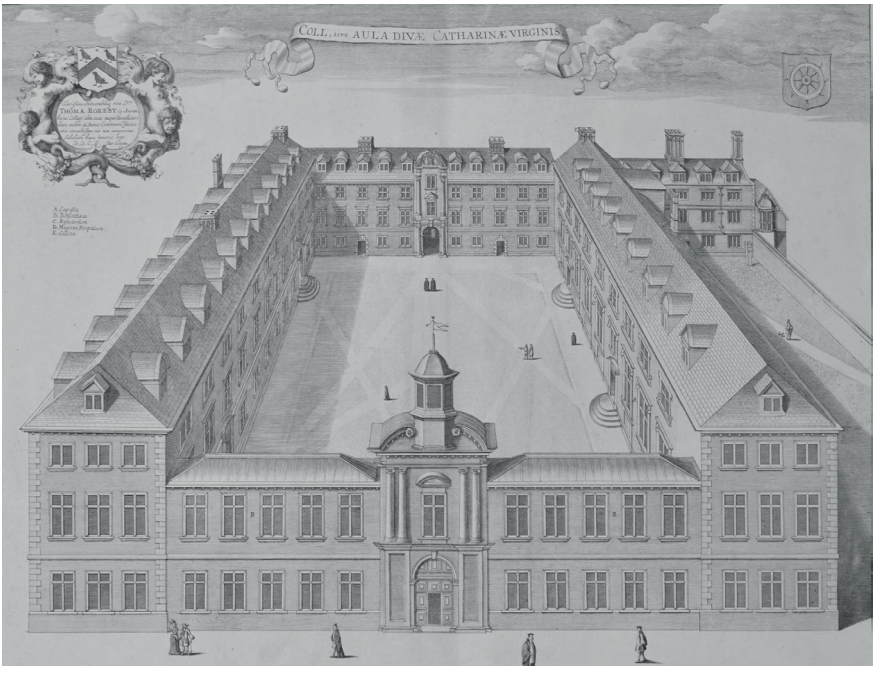

Figure 9
Print showing original intention for St Catharine's College (not built) from Loggan (1690). The idea of an open court seems to have been Essex's. In this plan the front range housed the library

details of the original facing 17th century range. The college had been founded in 1473, but the first buildings that were constructed between parcels of land were short-lived and unsatisfactory. The college we see today was the result of a comprehensive campaign of rebuilding in the 17th century and continuing into the 18th (Bradley and Pevsner 2014, 186).

Loggan's print of St Catharine's (Fig. 9) shows the original intentions for the completion of the court with a library on the front, but in fact the court was far from finished at this point and was missing both the chapel and the southern range (on left of this picture). Progress was hampered by the difficulties of buying many of the properties on the site and it was only in the 18th century that the last of the properties on the Trumpington Street side were purchased. At this point closing the court would have been possible, but it is likely that it was Essex that persuaded the Fellows to leave it open, echoing his much earlier design for a court opening to the street for Corpus opposite (Fig. 10).

Figure 10
Engraving by Woodyer, from Betham and Thurlbourn's *Cantabrigia Depicta* (1763) showing St Catharine's as built, with Essex's Ramsden building on the left mirroring the chapel on the right

As well the idea of an open court, Essex's main contribution was the building that formed the street end of the south range of the court: the Ramsden building. This was funded by a legacy from Mrs Mary Ramsden to house six Fellows and ten scholars whose maintenance she also left money for (Willis and Clark [1886] 1988, ii: 84). The two staircases which survive intact serve panelled chambers on each floor. The end of the block is plain and detailed to mirror the chapel on the other side of the court (Fig. 10). The plan is slightly unusual in that the first staircase only serves one set of rooms on each floor and the second staircase has two sets of rooms on each floor, the building being deliberately truncated to match the chapel. It shows Essex was a competent architect, if not at this stage a particularly exciting one.

The building seems to have taken an exceptionally long time to build, not being occupied until 1772 (RCHME [1959] 1988, ii: 184). Thomas Cocke, the architectural historian, also claimed that Essex designed the library in 1756-1763 (Cocke 1984, 12). This would make sense, but I have not been able to find any evidence to support it. The plasterwork was by Clark and the woodwork by Thomas Woodward who Essex employed elsewhere (Bradley and Pevsner 2014, 190). Essex was certainly responsible at the end of his life for designing the railings and pillars that finish the court (Cocke 1984,12).

Christ's College, First Court (1758-1775)

In 1758, following on from his work at Trinity and the refacing work he had done with Burrough elsewhere, Essex was engaged to reface the first court of Christ's College (Fig. 11). The original buildings had been built in clunch with brick bonding courses between 1505 and 1511 (Willis and Clark [1886] 1988, ii: 222). As it had at Queens', so here clunch being a very soft stone, the walls had eroded badly over time. The exterior of the court had already been refaced by others between 1714 and 1740 (Willis and Clark [1886] 1988, ii: 223-24). Essex was then employed for refacing the walls of the inside the court in successive stages from 1758-1775 (Willis and Clark [1886] 1988, ii: 223-24). No one seems to have noticed hitherto that some of the drawings are preserved in the British Library (BL Add Mss 6776 ff.87, 88). Interpretation and identification of Essex's contribution is made more complicated because extensive refacing work had already been carried by Robert Grumbold and others in the early 18th century and the fact that the Dining Hall was rebuilt by George Gilbert Scott Jnr. in gothic between 1875-79 and the Master's Lodge has been significantly altered (Bradley and Pevsner 2014, 60).

Figure 11
Engraving by Storer, 1834, showing the north range of the first court of Christ's as refaced by Essex. The doorway in the background lead to the chapel. Essex has added a parapet, sash windows and doorways with pediments

Essex's work at Christ's is typical of the refacing he and Burrough did in other colleges (Fig. 11). The walls are faced with Ketton stone, but the opportunity is taken to enlarge the staircases and medieval windows to bring more light into the rooms and replace the casements with 18th century sashes. Window sills are simple rectangles, with relatively plain architraves of a standard pattern. Pediments are placed above the doors. In general, the effect is balanced and restrained and the only flourish is a Serlian window inserted in the first floor of the gatehouse facing into the court. The work at Christ's can thus be seen as a continuation of the work Essex had been helping Burrough with elsewhere. Essex was by the late 1750s becoming the person to go to if you were having problems with crumbling college buildings.

1760-65: The Death of Burrough: Emmanuel, Jesus and Clare

In the 1760s we enter a new phase. James Essex's friend and mentor, James Burrough, died in 1764 in his early seventies. Essex had been doing his drawings for over 25 years and increasingly in this period the elderly Burrough seems to have been happy to pass commissions straight on to his younger protégé, although by now Essex was sufficiently well-known in the small world of Cambridge colleges to attract commissions in his own right. In 1760 Essex was still working on St Catherine's and Christ's and in the next five years added to this work alterations to Emmanuel and Jesus, but his most exciting commission in this period is a whole new building, Clare College Chapel, the last project he would do with Burrough.

Refitting and Refacing the Hall at Emmanuel 1760-64

Essex had produced a survey for Emmanuel College around 1745 but his first involvement in building was in fitting out the dining hall between 1760 and 1764 (Cocke 1984: 11). The interior he designed is still used today. As in other colleges, Emmanuel's first court had been built in phases in the 16th and 17th centuries but the original ranges had been poorly built and by the middle of the 18th century were beginning to fall apart (Willis and Clark [1886] 1988, ii 711). Burrough had previously been asked to redesign whole entrance range and the hall in 1752, but his plans were rejected (Willis and Clark [1886] 1988, ii: 713-14). Eight years later, with the building deteriorating alarmingly, it was agreed that Essex should carry out a more modest plan for re-ordering the hall (Willis and Clark [1886] 1988, ii: 714).

The chief changes were the introduction of a flat plaster ceiling under the existing timber roof, changing the wall panelling and classicising the screen (RCHME

Figure 12
Clare College Chapel, south elevation (photograph by James Campbell).

[1959] 1988, i: 67). The proportions of resulting space are determined by the shape of the original building and the result is only partially successful, feeling like a strange compromise between a gothic and classical design. On the exterior, Essex unifies the court by refacing the building in ashlar and framing the windows with classical architraves, although Essex's work here would be altered by later additions. The Fellows obviously approved of Essex's work because five years later they commissioned Essex to redesign the entrance front (see below).

Refitting the Combination Room at Jesus 1762-63

The second internal refit that Essex was asked to carry out in this period at Jesus College was even more modest than his work at Emmanuel and again remains intact. The room in question had been used as a parlour since the 16th century. In 1758, Francis Lord Middleton (1692-1758), an alumnus of the college, left money for it to be refitted. James Essex was hired to carry out the work (Willis and Clark [1886] 1988 ii 164). He inserted Georgian panelling with a dado enriched with guilloche and a dentil cornice and a matching fireplace (RCHME [1959] 1988, i: 92). He also rebuilt the arches in the cloister (1762-65) and in 1784 carried out internal minor works in Principal Court (Cocke 1984: 11).

Figure 13
Dome of the Anti-chapel, as completed by Essex (photograph by James Campbell)

Clare College Chapel, 1764-69

Clare College had dramatically rebuilt in the 17th century. Robert Grumbold had moved the front of the college back from the street and its original building line to avoid being overshadowed by the now finished Kings College Chapel. There had however been no money to rebuild Clare's College chapel which remained in its original position and form, adjoining the street and now sticking out in

Figure 14
The interior of Essex's chapel at Clare College, his last collaboration with Burrough who died during its construction. (Image by Storer, 1834)

front of the new entrance. It was only with the bequest of the Master, Dr John Wilcox, in 1762 that the college finally raised enough money to start construction (Brushe 2000: 84). The elderly James Burrough was the named architect with James Essex being appointed as the carpenter and overseer of the work (Willis and Clark [1886] 1988 iii: 540-41). It is an important reminder that Essex continued to act as a carpentry contractor throughout this period and never stopped being a builder as well as an architect.

The old chapel was demolished in between February and May 1763 and the foundation stone of the new chapel was laid at 1pm on 3 May by the Master Dr Stephen Goddard (Willis and Clark [1886] 1988, i: 115). Burrough died on 7 August 1764 in Caius, having spent the morning with Essex (Brushe 2000: 85). Thereafter Essex took over and was paid as the architect. An unsigned early scheme survives which is presumed to be a design by Burroughs which shows a relatively plain building with a Serlian window at the end (Brushe 2000: 85). This scheme was abandoned. Drawings by Essex survive showing the scheme with its dramatic octagonal top lit domed anti-chapel (Fig. 13) and shallow barrel-vaulted chapel as built (BL Add Mss 42569 ff.4-6). The general consensus is that these elements were introduced after Burrough's death. If that is the case they must have been introduced very late as the foundations and lower walls would have already been complete but this would have certainly been possible. However it seems more likely that Essex and Burrough designed the scheme together, with Essex drawing up the plans and elevations and developing it up after Burrough's death. There is no doubt that the finishing of final interior was overseen by Essex and that much is thus definitely to his design and the college paid him accordingly (Bushe 2000: 90). Of all his surviving buildings, it is by far his most successful (Fig. 14). The roof was complete by 15 December 1765, but the interior decoration work took another three and half years, the building finally being completed in July 1769 (Willis and Clark [1886] 1988, i: 115).

1766-1769 The Senate House and Randall House

The second half of the 1760s, Essex was busy in Cambridge. He was overseeing the refacing of Christs, still working on the Ramsden building at St Catharine's, overseeing the building of the new bridge for Trinity (see below) and completing the chapel at Clare. He did however find time to take on two new commissions: the West front of the Senate House, and a private house in Trumpington Street.

Finishing the Senate House, 1766-68

The story of the building of the Old Schools and the Senate House is complicated. John James and William Dickinson both submitted designs for the Senate House, but it was James Gibbs who was chosen as the architect and whose design had been built between 1722 and 1730 (Salmon 2022). Its windows and panelling were made by James Essex the elder. Gibb's drawings show that he intended the West end to be continued in an extension to the Old Schools which was to house the University library and that this was to link to a second set of offices on the south side which would mirror the Senate House and form an open

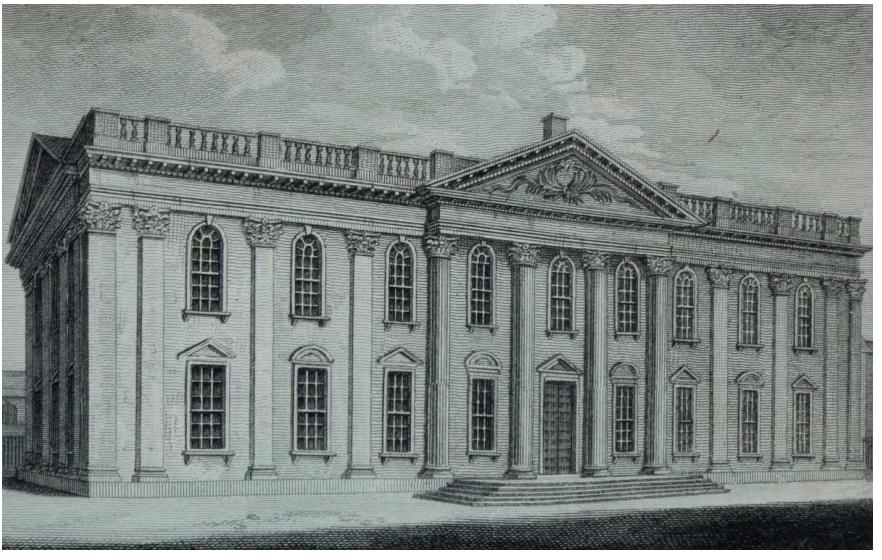

Figure 15
Plate from Dyer's *History of the University and Colleges* (1814) drawn by I.H. Baldrey and engraved by J Geig. Essex's end façade is on the left

court (for an engraving see Salmon 2022: 30 Fig. 9). In the end after decades of arguing, this scheme was abandoned in favour of the current arrangement for the Old Schools which was designed by Stephen Wright (?-1780) and built between 1754 and 59. Wright's scheme abandoned the idea of joining the Senate House to the main buildings, linking them only with a wall. However, because it had never been intended as an outside wall, the West end of the Senate House remained an unfinished blank façade in rough brickwork. Sir James Burrough left money in his will for its completion.

The complete story of Essex's involvement in the designs for this face of the Senate House is told at length in Willis and Clark who reprint the account of John Smith, the Master who took over from Burrough at Caius (Willis and Clark [1886] 1988, iii: 69-71). Essex was commissioned to carry out the work. He produced some cheaper designs which are preserved in the British Library, but these were rejected in favour of more elaborate ones (BL Add MSS 42569 ff. 1-7). The work was carried out between November 1766 and March 1768 (Willis and Clark [1886] 1989, iii 69-71). The project was a difficult exercise in design as there are no windows and the whole had to be entirely composed of shallow niches, cornices, and pilasters. Essex managed to achieve a satisfactory result which blends seamlessly with the rest of the building (Fig. 11)

Randall House, Trumpington Street, 1768

The house, previously known as Kenmare, is a townhouse on Trumpington Street directly opposite the front gate of Pembroke College and has at the time of writing just been incorporated into the extensive development for Pembroke on the other side of the road from its main site. Although extensively remodelled internally the front elevation survives intact. The site for the house was purchased by John Randall (1717-1799) who has an organist and composer and Professor of Music in the University in 1768. Randall had the distinction of being simultaneously organist at Kings, St John's, Trinity and Pembroke Colleges.

Figure 16
Randall House (Kenmare) as it exists today. A modest building possibly over-loaded by too many Serlian windows on one façade (photograph by James Campbell)

Drawings for various schemes for the house are preserved in the British Library (BL Add Mss 6776 ff. 90-93). Its main façade is on Trumpington Street (RCHME [1959] 1988, ii: 301, 354). The designs seem to have involved keeping various older existing buildings behind, but adding new grand rooms on the front and producing an imposing front façade. The house is set back from the street and originally had a small court enclosed by railings which were sadly removed in World War II (RCHME [1959] 1988, ii: 354). The entrance is on the *piano nobile*, reached by a short flight of steps, the services being in a half basement lit by an area in front. Essex decided to compose the façade in buff brick with four Serlian windows (Fig. 16).

1770-1775 Kings, Trinity, Emmanuel and St John's

By 1770, James Essex was at the height of his career in Cambridge. As a building contractor he was actively involved in buildings all over Cambridge but, with the sad death of Burrough, he was also now the most consulted architect in the town. Much of the work was repairing and reordering. He was still working at Christ's and the Ramsden building at St Catharine's. His new work was at Kings, Emmanuel and St John's.

Repairs to Kings College and new altar and reredos 1770-76 (dem.1897)

While Kings College Chapel is rightly famous as a masterpiece of perpendicular gothic architecture, the building had a long and complicated history. In the long and protracted building process any original intentions for the altar seem to have been lost. An altar was installed in 1544-45, but this was destroyed under Edward VI. A new one was built under Mary and this in turn destroyed by Elizabeth I (RCHME [1959] 1988, i: 115). In the 17th century a richly adorned new altar was constructed in a timber screen set forward of the wall at the East end of the chapel. A contemporary description is reprinted in Willis and Clark (I: 525). This 17th century arrangement remained in position until the end of the 18th century when James Burrough was asked to provide a new design in 1758-59. These plans were shown to various authorities in architecture for their opinion and found wanting. While deliberations were still going on Burrough died.

James Essex's own interest in King's predates Burrough's plans for the altar. He had in 1756 advertised for subscribers for a book he was going to write on the chapel (Cocke 1985: 111). The surviving drawings in the British Library show that he made considerable progress in surveying the building (BL Add Mss 6776 ff.8r.-32r.). The book was never completed, however the fact that he knew

so much about both Gothic architecture and the chapel may have led the College to approach him for more designs for the altar. Essex told them at this point that he had drawn the original drawings "under the direction of Sir James", an interesting description of this working relationship.

In 1766 Essex produced a new scheme for the altar in Gothic style. This was approved and an estimate was asked for. However, this came in at £1550 which was more than the £1000 budget and was thus rejected (Doig 1978: 79). The college then sought the advice of James Stewart (aka "Athenian Stewart") and James Adam (Doig 1978: 79-80). Stewart declined to act, but Adam produced two designs. The first was classical and partly obscured the window. It was generally accepted that all designs had to be gothic, so he was asked to resubmit. The second scheme also proved unsatisfactory and too expensive and was rejected in 1769 (Doig 1978, 81). Adam was paid a fee for his trouble. It was almost certainly on the advice of William Cole, a Fellow and antiquarian and of Horace Walpole that Essex was at this point approached again by the College in 1770. Both Walpole and Cole knew that by this time Essex had not only produced his drawings for his history of the chapel but that he was discussing a much larger project on Medieval architecture (Doig 1978 81). As they pointed out, his practical knowledge of building combined with his antiquarian understanding of Gothic architecture made him uniquely fitted to the task.

In 1770 Essex duly produced a revised gothic scheme for the altar which was finally approved and built. It was completed in 1775 at a cost £2018, over £500 more than his original rejected scheme (Doig 1978 82). The bill and receipt are preserved in the college archives (Kings KCC/280). Essex's altarpiece was replaced in 1911 by an altar designed by Thomas Garner in front of a reredos designed by Detmar Blow and Fernand Billerey (RCHME [1959] 1988, i: 115). We have only a few views showing what Essex's was like and some of the timber work was re-used in the Hall screen (Fig. 12). What they show is that Essex had been at pains to produce an altar that appeared to be genuinely gothic and designed to blend seamlessly with its surroundings. It is sad that it was removed.

Trinity Combination Room 1771-74

While Essex's work at King's is mostly lost, his new building at Trinity remains largely intact. Trinity's Great Court has a very complicated history. Essex's building replaced what had been the original dining hall. When a new dining hall was built in 1604-1605, a new kitchen was constructed with the buttery in the shell of the old hall and the combination room above it on the first floor. This fitting out of the carcass of an existing building was not entirely satisfactory. The opportunity to replace it came with a benefaction on the death of Francis Hooper

Figure 17
Plate from Dyer (1814, after p.205); showing Essex's altar in place.

Figure 18
Trinity Combination Room to the left of the hall. Plans were briefly discussed for continuing the whole of Great Court in the same style but quickly rejected. The Combination Room is on the first floor (Photograph by James Campbell)

in 1762 of £1000 for "rebuilding or altering and ornamenting of the Combination" (Willis and Clark [1886] 1988, ii: 606). In fact, the money was redirected to the more pressing immediate problem of replacing the bridge (see below) in 1764 and this first brought Essex into the employment of the college (Willis and Clark [1886] 1988, ii 606). However, Hooper's request was not forgotten and further money was found in 1770-71 to carry out his wishes. Essex's designs provided three floors of accommodation and cellar. The buttery occupied the ground floor, connecting with the kitchen, with cellar beneath (Willis and Clark [1886] 1988, ii: 606). A wooden stair leads to the first floor with a small combination room and a large room that rises to the roof (30ft x 36 ft x 18 ft 6 inches high) occupies the three centre bays. Student rooms are provided over the smaller combination room on the top floor. The outside of the range is relatively plain, faced in Ketton stone and blends well with the rest of the court in colour, if contrasting in style. The main room has panelling to dado height and a delicate plaster ceiling in an Adam style (RCHME [1959] 1988, ii: 213).

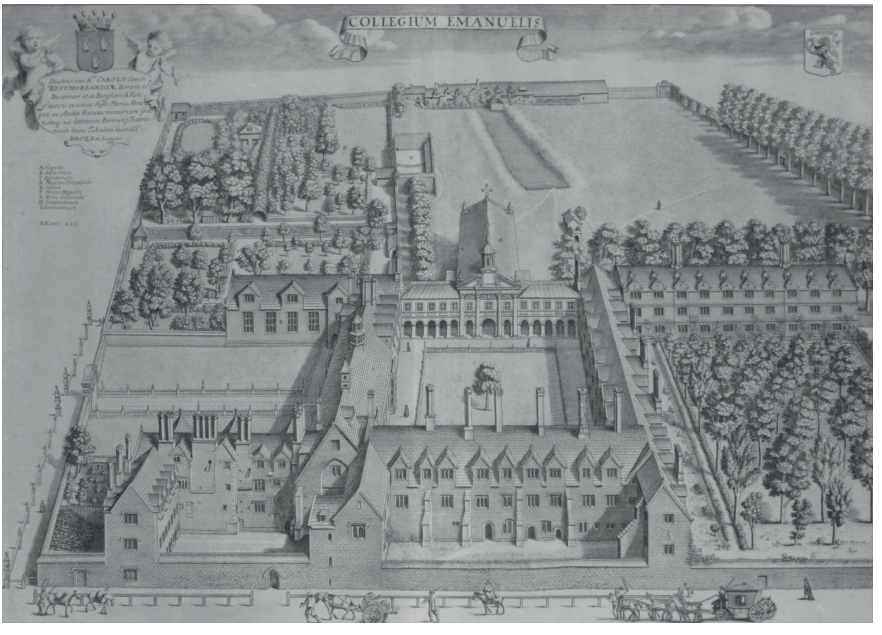

Figure 19
Print showing the buildings that formed the street front before Essex's intervention (Loggan 1690)

Entrance Front, Emmanuel 1771-75

Today we associate the first courtyard of Emmanuel with Christopher Wren, but in fact much of this courtyard was created by Essex in direct response to Wren's chapel. The Loggan print clearly shows how different the courtyard was before subsequent rebuilding (Fig. 13).

In 1752 Emmanuel College had approached James Burrough to produce plans which included rebuilding the whole West entrance side of the court opposite Wren's chapel, but Burrough's scheme had been abandoned for Essex's more modest re-ordering of the hall (Willis and Clark [1886] 1988, ii: 713). In March 1769 the older buildings on this side of the court were becoming dangerous and so the college decided to rebuild them, initially to Burrough's plan (Willis and Clark [1886] 1988, ii: 714). As Burrough had died five years earlier, they approached Essex who produced a revised scheme which was approved in July (Willis and Clark [1886] 1988, ii: 715). Work on demolition started immediately but it took time to raise capital and the buildings were not finished until May 1775 (Willis and Clark [1886] 1988, ii: 715).

Figure 20
Engraving by Sparrow, 1807 showing Essex's new front (Deighton and sons 1807)

An engraving of the approved design was made to raise money, but evidently changes were made subsequently to the entrance which in the engraving has columns rising from above arches, whereas the design that was carried out has giant ionic orders from the ground to roof. The fact that today the first court appears to have been planned around the Wren chapel is entirely the happy result of Essex's new front, which creates the entrance on axis that was fundamentally missing when Wren's scheme was completed. Pevsner lamented that the portico was not big enough to stand between the two end pavilions (Bradley and Pevsner 2014: 93). Nevertheless, the scheme shows Essex's confidence in design at this period and this is undoubtedly one of his finest works.

Refacing of First Court St John's (1773-5)

On the 20 February 1772 in St John's a College Order "Agreed that the side of the first court opposite to the chapel be covered with stone, sashed, and otherwise improved agreeably to a plan given in by Mr Essex." (Willis and Clark [1886] 1988,

ii: 317). The College Audit book states that in 1772-3 Thomas Sandby had been consulted, come to Cambridge and drawn up plans but Essex's designs were preferred. The work was carried out between on the South range between 1773 and 1775 (Willis and Clark [1886] 1988, ii: 318). What is interesting is that Antiquarian protests prevented the rest of the court being treated in the same way, showing how the tide was now turning against the whole-hearted refacing of Medieval courts and towards restoring them while keeping their medieval character. It marks the end of the Burrough-Essex campaign to classicise Cambridge courts.

1776-1784 Sidney Sussex, St John's and the Guildlhall

In the final decade Essex was busy working for Walpole at Strawberry Hill and advising on Winchester and Canterbury Cathedrals. At St John's, following the refacing of first court he produced plans for re-ordering the chapel and part of the Master's lodge, but these were not executed. He also carried out repairs to the foundations of third court (1777) and the library roof (1783). His major works in this period were for Sidney Sussex and for the city of Cambridge, both sadly now lost.

Sidney Sussex Library and Chapel, 1776-82

James Essex's work in the chapel has been almost entirely concealed behind later additions and alterations by Wyattville and the library has been stripped of its fittings (designed by Essex) and turned into a function room. Essex's work can thus only be reconstructed with difficulty. The events surrounding building are however recorded in the archives. By the middle of the 18th century Sidney Sussex's buildings were in a very poor state of repair. In 1749 the Hall was refitted. A flat ceiling was inserted under the hammer beam roof and panelling was added. Sadly, the name of the architect responsible is not recorded but it would not be unreasonable to suppose that it might have been James Burrough. In 1774 attention turned to the range including the part of the Masters Lodge and the chapel, which was "quite worn out" (Willis and Clark [1886] 1988, ii: 742). Essex was asked to draw up plans for the chapel in March 1775 and for then to extend the plans further to include a chapel and library (Willis and Clark [1886] 1988, ii: 742-3). More plans were produced between April and October and in 1776 Essex was directed to proceed and demolition of the old buildings began. These revealed the foundations of earlier structures that Essex eagerly recorded (Willis and Clark [1886] 1988, ii: 743-4). Work then began on the new buildings which were completed in 1779 (Willis and Clark [1886] 1988, ii: 745). Almost all of Essex's work was wiped away when Wyattville gothicised the college in the 19th century, refacing the courts and added crenelations. The chapel was completely refitted

and lengthened by T.H. Lyon in 1921-3 (Bradley and Pevsner 2014: 214). Some of his library interior survived, much altered, into the 20th century (Willis and Clark [1886] 1988, ii: 749-50).

The Guildhall, 1782-4 (dem.1933)

The Guildhall in Cambridge was his last design for the city. The current Guildhall in Cambridge by C. Cowley-Voysey completed in 1939 (Bradley and Pevsner 2014: 299). It sits on the site of two previous buildings: the Shire Hall and the Guildhall. This has caused some confusion. Images of the Shire Hall which fronted onto the market place in the 19th century are often cited as being of James Essex's Guildlhall, but this is not the case. The Shire Hall was designed by John Sharman and Richard Barnett of Peterborough who were paid 20 guineas for their trouble and was built by Thomas Petgrove and John Newling in 1746-47 (Colvin 2008: 915 — payment recorded in Cambridge Quarter Sessions Order Book 1738-1758, 18 July 1746). It was this Shire Hall that fronted onto the Market Square. The Guildhall was behind the Shire Hall in a small courtyard surrounded by other buildings. It was thus concealed from the Market Square and from the street. No exterior view survives, but then it was not a building de-

Figure 21
The only interior view of Essex's Guildhall (Keynes, 1947: plate VII). Note the Serlian windows with their sliding arched sashes

signed to be seen from the outside. It was another of Essex's buildings where the interior was more important than the exterior, a fitting end to a career that had been made out of such buildings. A series of drawings survive in the British Library (BL Add Mss 6776 ff.47-53). An internal view can be found in a newspaper article reprinted in Keynes 1947 (Fig. 21). These show the handsome classical room lit by large Serlian windows; the Serlian window being a form which Essex seems to have particularly enjoyed. The building was demolished in 1933 to make way for the new one.

Bridges over the River Cam

So far we have concentrated on Essex's buildings but before finishing this account of his work in Cambridge we need to say something about his bridges. Essex's work on the wooden bridge at Queens' to Etheridges's plans has already been mentioned and has its own chapter in this book (see below). Its survival and prominence makes it the most documented of all the bridges that Essex was involved in. However, Essex went on to do a number of other bridges over the Cam. Those documented are: the Great Bridge, Garrett Hostel Bridge and the bridge at Trinity. It is also quite possible he was also responsible for a bridge at Silver Street, now lost.

The Great Bridge across the Cam, 1754

In 1754 Essex rebuilt the stone bridge across the Cam in Bridge Street by Magdalene College (RCHME [1959] 1988, ii: 309). The previous bridges at this location were timber and had to be periodically replaced. Essex was thus commissioned to build a stone one. The exact form of this bridge is unclear. No drawings survive and the bridge itself was replaced by an iron one in 1822. One surviving image on a website suggests that Essex's bridge was stone and consisted of a single arch, but it is not clear how authentic this image is.

Trinity College Bridge 1764-65

Trinity Bridge over the river, W. of New Court, was rebuilt to the designs of James Essex in 1764–5. The cost, £1,500, was defrayed from a bequest of Dr. Hooper, whose arms it bears. The materials from the old bridge of 1651–2 were used in the substructure (RCHME [1959] 1988, ii: 209). Designs for the bridge are preserved in the British Library (BL Add Mss 6776 ff.). The drawings include pencil sketches for the centering for the arches.

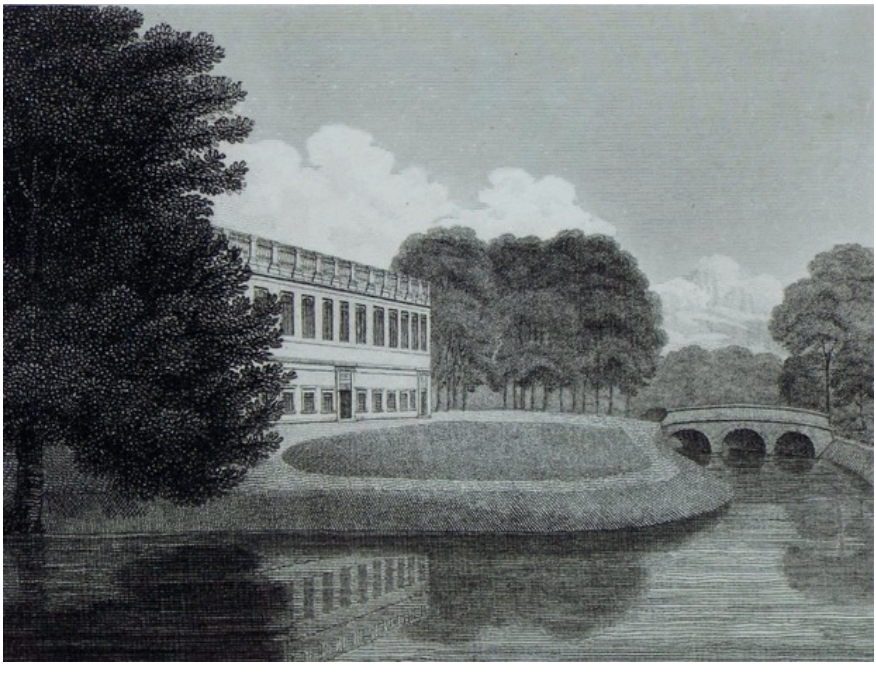

Figure 22
View of Trinity Bridge from the backs (Dyer 1814: after 332)

Garrett Hostel Bridge

The 1769 Garrett Hostel Bridge was reconstructed by James Essex in brick and timber. It was known at the time as the "Mathematical bridge" and on its demolition it is quite possible that this name was mistakenly transferred to the bridge at Queens'. Until then, both Trinity Hall and the town had been responsible for upkeep, but the former paid half the cost of this reconstruction to obtain future exemption (RCHME [1959] 1988, ii: 309). A surviving view (fig.23) shows that it was a steeply sloping arched timber bridge.

Possible Designs for Silver Street Bridge 1777

One last bridge may have been designed and built by Essex, although this is yet to be proven. In the British Library there are a pair of designs for a low wooden bridge with straight cross-braced parapets (BL Add Mss. 6776 ff.85-86). In 1777 the City of Cambridge paid for a new wooden bridge at Silver

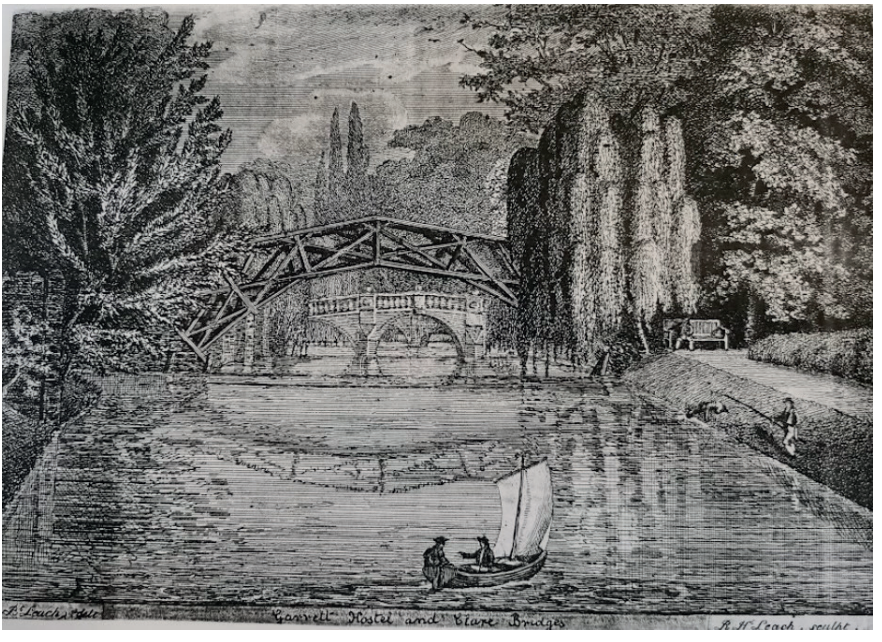

Figure 23
Engraving by R.H. Leach showing Essex's timber Garrett Hostel bridge with Clare College bridge in the background (c.1812)

Street. Nineteenth-century engravings show this bridge had straight cross-braced parapets like the ones in Essex's drawings however the number of supports and other features do not match so these may have been alternative schemes for other bridges. Nevertheless it seems not unlikely that the city might have employed Essex to design and build the bridge as he had by this time designed and built four of the eight bridges then over the Cam. The wooden Silver Street bridge was replaced by an iron one in 1841, which was itself replaced in 1958-59 by the current one to 1932 designs by Edwin Lutyens (Bradley and Pevsner 2014, 307).

Creating the Burrough Style

When looking at the various buildings that Essex and Burrough collaborated on together, a clear and definable style is evident. For the exteriors, the key to the style was the alteration of window openings to provide large rectangular openings of classical proportions for 12 or 16 light sash windows, surrounded on three sides

with a typical architrave seated on a simple rectangular sill. The wall surface was as plain as possible, ideally ashlar (or failing that buff brick) and topped by a plain solid parapet. Slate roofs are then punctuated by timber dormers. Doorways have plinth blocks, the same architrave as the windows and where possible a simple triangular pediment. This was a simple and effective formula. Very often these were little more than facades added to existing Medieval buildings, whose interiors were then panelled but retained the original proportions of the rooms. Sometimes, as at Queens', existing Medieval buildings were swept away to create a new one. However, the strategy was formulaic and the aim seems to have been to uniformly smarten up Medieval courts which were not only in very poor repair, but also seen as archaic and in need of modernisation. The downside of this process was the destruction of the original fabric. Between them, Burrough and Essex probably destroyed more Medieval fabric in Cambridge than any other architects before or since. This seems particularly ironic as Essex was himself in later years so interested in preserving Gothic architecture and was one of the pioneers of its study.

Legacy

There can be no denying that James Essex changed Cambridge. For several decades in the late eighteenth century, he was the most popular architect in the city. That is not to say that the Fellows of Cambridge colleges were ignorant of fashions elsewhere. Indeed, as we have seen, on many occasions the famous architects of the age were asked to produce drawings and were paid for doing so, but found that the commission went not to them but to Essex instead. Essex produced professional drawings in the same grey wash style that had come out of the office of works in the early 18th century and was used by fashionable London architects (Harris 2002). Essex's advantage over his more famous London contemporaries was that he understood Cambridge. He knew the complexities of working within the college system and how it operated. He understood what they would be willing to spend money on and what they could not, or would not, afford. No doubt he had learnt all of this from Burrough, a Cambridge academic and architect. Indeed, Burrough was the first architect to become Master of a Cambridge College and Vice Chancellor of the University. There was no one better connected. But Essex, unlike Burrough, was also a Cambridge man and the City were equally happy to commission him to build bridges and the Guildhall. And Essex was also a builder. He understood how to manage jobs on site and how to get things done. He knew which local craftsmen could be trusted and which to avoid. This made him invaluable and gave him an undeniable advantage over his rivals.

One criticism of Essex's designs is that they are rather plain. In his defence it must be pointed out that most of his clients were not wealthy. The University in

the 18th century was at its lowest ebb and the colleges had few students and little money. Indeed in 1775 the whole University could boast no more than 150 matriculating undergraduates each year (Bradley and Pevsner 2014, 23). Then, as now, Cambridge colleges relied on donors to pay for buildings. Much of his work was repairing and shoring up buildings that after centuries of neglect were now in serious danger of collapse.

It is important to note that Essex throughout his life combined architecture with building contracting. Indeed, as Thomas Cocke pointed out, he could not afford to do one without the other (Cocke 1985, 104). His architecture and surveying posts brought him little financial gain when he did the design alone. It was only when he oversaw the whole project that he could charge the 5% fee. So for the re-facing of St John's the works cost £2700 and he received £135, and similarly the combination room at Trinity cost £4500 and he received £233 (Cocke 1985, 104). Surveying alone was less profitable. For the four years he spent 'surveying repairs and new buildings" at Neville's court between 1754 and 1758 he had only received £120 (Cocke 1985, 104). It was only because he had made so much money as a builder that he could afford in later years to become exclusively a consulting architect. For Lincoln, his fee was a silver salver, while at Strawberrry Hill he refused any kind of fee for his initial designs and was only paid £31 10s for his later work on the Beauclerk tower and office range (Cocke 1985, 104). It was the money that he made as a builder that produced the £20,000 he left behind on his death (Cocke 1985: 201n.20).

Essex as a builder is also interesting. His father was usually described as a joiner because he was responsible for fine panelling, bookcases and sash windows. James Essex is sometimes also described as a joiner, but there is no doubt much of his building work was more carpentry than joinery as it involved the major structural work in buildings or the building of bridges, and his work extended beyond that to general building works. As such he was part of a general trend in the 18th century, which has been noted elsewhere, for builders to move away from just acting in one trade and move increasingly towards being the sort of general contractors who would dominate nineteenth century building practice. This no doubt also helped boost his profits and meant that Essex was increasingly well off.

In his later years, as Essex walked out from his house opposite St Catharine's and strode around the City, he would have been able to see buildings everywhere that he had designed or worked on. There can be no doubt that he changed Cambridge and his legacy is still very much on display. He may have been fascinated by Medieval architecture and respected for his studies of it, but we can be relatively certain that he would have also wanted to be remembered for his Cambridge work and for following in Burrough's tradition of classicising Cambridge.

Chronological List of Works by James Essex in Cambridge

1750-51 Dome for manuscripts room in University Library (destroyed 1864-5)
1754 Rebuilt Great Bridge (demolished 1823)
1754 Doctors gallery, Great St Mary's Church (removed 1863)
1755 Refaced Neville's Court, Trinity
(1755-56 Assisted Burrough in his refacing of Peterhouse main court)
1755-58 Fitted out library, St Catharine's
1756-60 Queens' College Essex Building
1757-60 Ramsden Building, St Catharine's
1757-58 New passage and panelling, Master's Lodge, Trinity
1758-75 Christ's College, First Court refacing
1760-64 Emmanuel College- refitted and refaced Hall
1762-63 Refitted Jesus College Combination Room
1763-65 Designed and built Trinity Bridge
1764-69 Clare College Chapel
1766-68 Senate House, West side
1768 Randall House (now Kenmare), Trumpington Street for John Randall
1769 Trinity Hall rebuilt Garret Hostel Bridge
1770-76 Repaired Kings College Chapel reredos and altarpiece (dem. 1897)
1771 Prepare designs for Downing (not executed)
1771-75 Emmanuel West Range (entrance front)
1771-74 Trinity Old Combination Room and range
1773-75 Refaced first court St John's
1773-75 Refitted chapel, Queens' (altered 1858-61)
1776-82 Sidney Sussex chapel and library (library remains, chapel altered)
1777 St John's third court foundation, Combination Room (dem. 1863)
1779 Altered panelled rooms over butteries, Queens'
1780 Screen and railings, St Catharine's
1782-84 Rebuilt the Cambridge Guildhall (demolished 1933)
1782-83 Repaired nave roof of Great St Mary's
1783 Repaired the library roof St Johns
1784 Alterations to interior and doorways, St Edward's church (removed 1858-60)
1784 Death of James Essex

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Essex and Carpentry: James Essex as surveyor and engineer

David Yeomans

There has always been a marked difference between those architects who care little for the practicalities of construction and those who engage fully with the construction process. James Essex, as the son of a carpenter and builder was destined to be one of the latter, but at a time when there was often little distinction between the work of architects and those of what today we would call a building surveyor his career included work that fell within that category. It was also a period when there was sometimes little distinction between work carried out by carpenters and what we would today regard as that of a structural engineer and we also need to place Essex's work within the context of other major engineering work of the time. The purpose of this essay is to consider this aspect of his work, i.e. as surveyor and engineer. The primary sources for this are James Essex's own papers, now in the British Library and his surviving structures, principally the rebuilding work that he carried out at Lincoln and Ely Cathedrals. However, there have been other studies of his carpentry work notably the drawings made by Cecil Hewett and the study by Heyman and Wade of the structure of the lantern at Ely and they will be drawn upon.

18th century carpentry

For members of the public who are able to associate the various buildings of Cambridge with the names of the architects involved, the structure that they will probably associate with James Essex is the so-called mathematical bridge over the River Cam at Queens' College. The college even markets a plastic kit to build

a model of the bridge with the legend "Put your mathematical skills to the test…". The design of this is dealt with by Jacques Heyman in a chapter of this book and the only comment necessary here is that it clearly marks Essex as a skilled carpenter even though his original structure has been rebuilt.

By the time James Essex was practicing architecture Francis Price had published an illustrated book on structural carpentry so that any carpenter in possession of this book would have been able to frame a floor or a roof even if they did not fully understand the mechanics (Price 1733). Price's publication would have been a useful guide for the average carpenter and so we might not expect anything out of the ordinary in Essex's general carpentry work. However, his roofs at Sidney Sussex College, where he rebuilt the East range of the South court, although of standard king post form, use rather smaller scantling timbers that one would find elsewhere in contemporary roofs. This suggests that Essex had an eye for economy.

Before that date some carpenters were already demonstrating a willingness to undertake what we might well regard as major engineering work. One of the most dramatic examples of restoration engineering of the early eighteenth century was carried out at Beverley Minster where the racking of the roof had led to the north transept gable wall overhanging its base of by as much as 4ft. There, between 1716 and 1720, William Thornton, working under Hawksmoor, devised a large timber cradle to bring this gable wall back to plumb, first having effectively cut the gable wall away from the side walls. This was shown clearly in an engraving published at the time and we can reasonably assume that Essex would have seen that (BL. Maps K. Top. 44.26.k. Published 1739). This may well have led to the rumour that Essex had carried out similar work at Ely although, as we shall see, there is no evidence for that.

The Essex papers

A glimpse into Essex's working life is provided by his correspondence with Richard Gough (Bodleian Gough Gen. Top. 46, ff. 139-261). This was a combination of a shared antiquarian interest and correspondence concerning a library that Essex was fitting up for Gough. In 1775 he reported that he had inspected the gate at Lincoln and the following year reference to corrections to the proof of a paper on Lincoln. In 1777 there were letters concerning estimates for a library. Apparently the window glass was to include a coat of arms because there are a number of letters about that, and by the beginning of 1780 the library was complete except for the glass. In 1782 they were discussing a paper on Gothic architecture and comparing Lincoln with York. Essex said that he did not inspect the Roman hypocaust at Lincoln because access was via the public sewer. In 1783 Essex was writing about

Rochester bridge and there was clearly a plan of this but not included with the letter. A feature of this exchange is that it took place when Essex was travelling. Occasionally the letters contain comments about their crossing in the post and the picture that emerges is that Essex was doing a great deal of travelling at that time.

Essex's working papers were bequeathed to Revd. T. Kerrich who subsequently donated them to the British Library. However, these do not form a simple collection because they have been 'curated' probably by Kerrich before they were bound by the Library into a number of volumes. In some of the volumes there are pages with just pencil notes indicating the nature of the following material, presumably inserted by Kerrich. In these volumes are survey notes for Ely and Lincoln, but these are far from a simple collection. Papers relating to different projects may be bound together or papers relating to the same project may be in different volumes. The confusion this creates is partly owing to the handling of the material by the British Library as the reports on the cathedrals are upside down in the bound volumes so that the pagination is in reverse. The date of binding, and so presumably the assembly of one of the volumes is given as 1958 (BL Add MS 6761). The date is stamped on the back cover of the binding. It also seems that Essex must have made two visits to these cathedrals because in another notebook, also upside down in the binding, is a note that begins "Observations on y Church of Ely made ^{y} 13th 14th & 15th of July 1757" (BL Add MS 6769). His extensive notes on Salisbury, which he clearly visited on his own account are in yet another notebook (BL Add MS 6768).

The volumes are of different size but the material relating to his survey of the cathedrals were written in small 'field notebooks'. These notebooks are somewhat smaller than those used by surveyors today, rather more the size a present-day policeman's notebook; small enough to be held in one hand. They were presumably chosen for ease of carrying while travelling because it is clear that he did travel extensively. One of the books, for example, contains notes on several places in the west country. Some of the notes in these books were probably made 'in the field' or 'on site' because they are in pencil while other notes in ink must presumably have been made at a desk, perhaps in some lodging.

At Ely Essex worked for five years from 1757, and then Lincoln from 1762. For those two cathedrals we have extensive records in his notebooks. Also, the archives of the local record office in Lincoln contain his final report to the chapter there. He also surveyed the roof of Winchester in 1773 and produced a draft for a new roof at Canterbury in 1776 but we have no records of those (Cocke 1985). We also need to consider his notebook on Salisbury Cathedral although he was not appointed there as a surveyor but which he seems to have visited before his appointment at Ely.

His writing in the notebooks is quite small and he also used abbreviations so that as much as possible could be fitted onto a page. Although these appear to be field notebooks the material on Lincoln, as well as direct observations, also includes general comments that would eventually be incorporated into his final report. It seems however that these small notebooks were a deliberate choice because he used the same size for his notes on Salisbury cathedral where he was not reporting on the condition of the fabric. There he would have made his notes while in the body of the church because they include sketches of the interior of the building. Therefore, the impression is that he wrote the reports on the other buildings while in lodgings at Ely and then Lincoln.

Apart from these small field notebooks are larger volumes, which contain, *inter alia*, the design sketches for the chapter house at Lincoln, reproduced below. There are drawings of other buildings including some for King's College Chapel in Cambridge and there are detailed drawings of a timber bridge: plan, elevation and cross section (Fig. 1). The structure of the bridge has a series of king post trusses as well as strutting from the supporting piers, but there is no indication of its location or whether this is a measured drawing or a design by him. Given that the cross section has a dotted line suggesting the profile of a gravel roadway, the latter seems the more likely although the detailing of it is rather odd. The struts under the deck appear to join into the post in a very uncarpenter-like way. It is difficult to imagine any carpenter forming tenons in the manner shown and there seems to be no reason why the main beams should be diminished in section at their ends. Also it is not clear how this structure would be assembled. Are the diagonals to the king post and those supporting the balustrade to be halved over each other? The letters

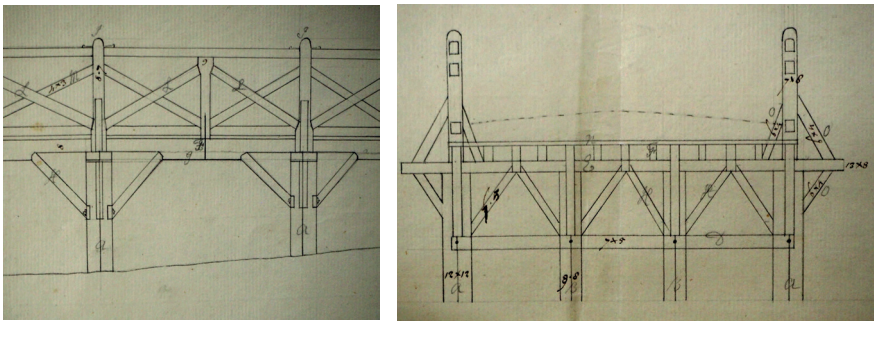


Figure 1
Design for a timber bridge – detail of the elevation and the cross section. (BL Add. Ms. 6776, f.86.)

on the drawing suggest that there was a text to accompany the drawings but that has been lost.

King's College Chapel

Among the papers are a number relating to King's College Chapel, Cambridge, which Essex made a study of. One intriguing drawing that sadly has no accompanying text is for a beam that appears to have some form of prestressing inserted into it (Fig. 2). This wedge arrangement at the centre resembles the device for trussing beams, a technique that was common in the eighteenth century. The so-called trussing of beams was thought to strengthen them although in fact the arrangement was completely useless (for an account of this method see Dawes, M.H., and David Yeomans. 1985). In this case the central iron bolt is attached to some lower arch shaped structure and there is a detail for a heel joint and the scarfing of a rafter. This page is bound with drawings of the roof of Kings College Chapel which include a study of its geometry so that, although not explicitly identified on the drawing, this must surely be a proposed detail for modifications to the tie beams of the roof frames. We know that Essex was concerned about the outward thrust imposed upon the top of the walls by the timber roof frames and it might well be that he assumed that this device could relieve the walls of some of this thrust. It would, of course, have little or no effect.

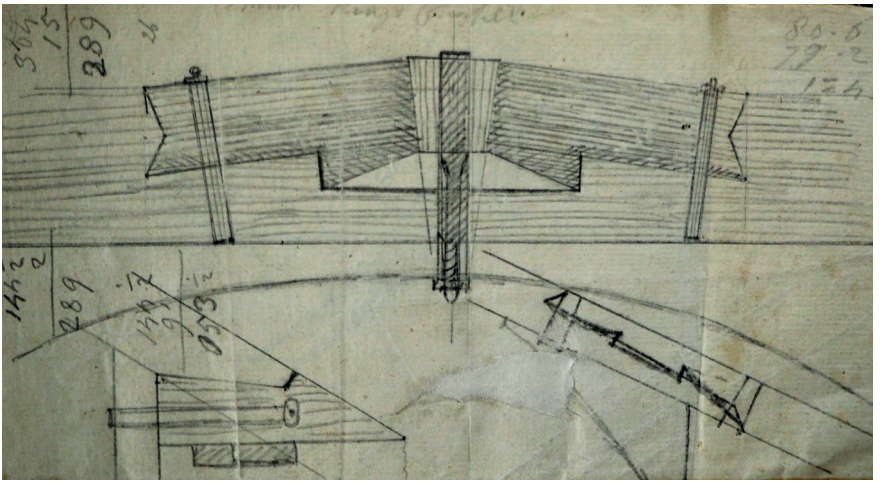


Figure 2
Details for the roof of King's College Chapel, Cambridge. (BL Add. Ms. 6772, f.26.)

The heel joint detail is also curious because it is not the joint actually used and recorded by him. The notching in the hammerbeam is not as built and the hammerbeam and wall post appear to be connected by a bolt with a caged nut. This device was to become common by the nineteenth century for connecting posts to tie beams but was not used in roof carpentry in Essex's day. However, handrail bolts used caged nuts so that Essex might have been adapting that device. These sketches give the impression that this is an exercise in how Essex might have designed such a structure.

Salisbury

Francis Price was the Clerk of Works at Salisbury Cathedral from 1737 when he seems to have immediately begun a campaign of extensive roof repairs and replacements, the latter using queen post trusses. He held the post of Clerk of Works until his death in 1753 in which year his *Observations* on the cathedral was published (Price, 1753). This provided an account of the building of the cathedral, details of its structure and the alterations that he supposed had been made during the life of the building. With his interest in Gothic architecture Essex would naturally have obtained a copy of this book and he then visited the cathedral to make his own observations (BL Add MS 6768). Essex's notebook contains a number of sketches of the building, observations on its possible history and noting where he takes issue with Price's views on the development of the building. He helpfully provides the relevant page numbers in Price's *Observations* (1753). His notes show particular concern for the building's structural behaviour and in how this was reflected in the building's history.

Essex took issue with a number of Price's views about the history of the structure and the alterations to it. That might seem presumptuous given that Price had spent many years at the cathedral with ample opportunity to come to know the fabric but, although we have no date for Essex's visit nor how long he spent there, it is clear from the details that he recorded that it was a sufficiently long visit for him to have made a thorough inspection. For example, where Price saw evidence of scaffolding (1753: 51). Essex found evidence of an earlier floor which Price seems not to have seen (BL Add MS 6768 f. 171). Of course, the finding or not finding of evidence to support a preconceived view of events is a well-known phenomenon and Price and Essex were starting with quite different views on the nature of the original design, i.e. whether it was with or without a tower.

We know that for many centuries buildings were not necessarily conceived and built as a complete work. In particular, a cathedral might be built without a tower or towers, which, whether at the crossing or the west end, would be added

later. Moreover, a tower might be built without a spire that was added later. The question for those concerned with structure is whether the masonry below these features was adequate to sustain the added weight. If not what effect did that weight have and what modifications were made to address the problem. Also, were such modifications made in anticipation of the added loads or in response to signs of distress in the fabric once the loads began to act. These are exactly the kinds of question asked by both Price and Essex.

The question of the tower and spire was his major disagreement with Price who believed that when the cathedral was initially built there was no intention to add either and, as a consequence, alterations had to be made to the supporting structure in order to carry the weight of these features. He believed that this accounted for the relatively thin masonry of the spire chosen to minimize the additional load. However, Essex commented that the thickness of masonry used was quite normal for spires. Essex believed that at least the tower had been planned for and that the additional supporting structures that Price thought had been inserted into the original fabric were, in fact, part of the original design and construction.

Essex's notes begin with a drawing of the tower and much of his notes are concerned with the strength of the supports. His assumption was that although the tower was conceived as part of the original design that was not necessarily so of the spire. Price simply thought, on stylistic grounds, that the cathedral was originally designed to be without a tower. This seems to have informed his supposed sequence of the construction of the arch braces to help support it. Price also cited Wren's view that the ironwork in the tower was to take the outward thrust occasioned by the spire because that had not been allowed for in the original design (p. 36).

What was of particular concern to Essex was the inclination of what he called the 'legs' caused by the pressure of the arches. The argument he put forward was that the increased weight upon the supporting arches increased the thrust that they imposed upon the supporting columns causing them to bend. Bending was also a problem noted in all the columns as the vaulting over the main body of the church produces an outward thrust on the columns while that over the lower side aisles produces an inward thrust. This seems to have been of particular concern to Essex.

> Hence all those then join to the great legs being acted upon by powers applied in different directions are cracked (BM Add MS 6768 f.160).

In fact, this was an argument put forward by Wren in his report on the cathedral and quoted by Price in his book (p. 18). It is this effect of arch thrusts on

columns that seems to pervade Essex's reports, which he considered to be a general problem in cathedral structures and not just when there were increases in the load. However, this concern did not result in his making any measurements of the amount of movement either at Ely or Lincoln.

What had been measured, but not by Essex, although it is perhaps the most obvious structural aspect of Salisbury Cathedral, was the extent to which the tower and spire are out of plumb, leaning towards the southwest. This Essex sensibly attributes to differential settlement of the southwest crossing pier, an explanation that Price seemed curiously reluctant to accept. This is not the place to go in detail into all the differences between Price's and Essex's view of the structure of the cathedral but, presumptuous though the latter's disagreements might at first seem, he does seem to have a much clearer handle on the behaviour of the building and the sequence of construction than Francis Price.

It might be worth noting that where Francis Price replaced the original roof of the cathedral he used queen post trusses which Essex was to use for his work on the east end roof at Ely.

Lincoln & Ely

Essex was consulted by the dean and chapter of Ely Cathedral in 1757 and subsequently was commissioned for work at Lincoln in 1761 and retained there as consulting architect until his death in 1784. Although Essex surveyed Ely first he made some general comments in his Lincoln notebook and report that apply equally to both buildings. He prefaced his report at Lincoln by general observations on the kinds of problems that might occur in any building.

> Amongst a variety of defects that are always found upon a general survey of so extensive a building as this, there are many which are common to most buildings of this kind and manner of construction: others owe their origin to the several alterations and additions which have been made in it from time to time since its first construction, and others from [y] decay[g] of the materials of which it is composed, which is often occasion[d] by a neglect of the necessary repairs, or an improper or injudicious manner of doing them; as these are principally to be regarded I shall begin with them, and first with the lead work & gutters (BL Add MS 6761, f. 72).

Well he might begin with this because it was the most serious list of problems with decayed leadwork occurring nearly everywhere, and of course, leading to decay of the timbers in places. At both Ely and Lincoln, he produced long catalogues of where the lead was bad and needed replacing.

Another observation in his Lincoln report, which applied to both buildings, was the problem of racking of common rafter roofs. The most serious of defects in the original construction was the failure of the carpenters to provide adequate bracing of the roofs to prevent racking. Again he wrote in reference to Lincoln:

> Before I leave this part it will be proper to observe that all ʸ upper roof have an inclination to run from the tower in the middle, which is a defect common to all roofs framed in this manner, where every pair of principals is designed to stand alone & haveᵉ no connection with each other they are easily put into disorder by ʸ falling of any one from ʸ perpendicular, whereas if they had been properly united to each other by braces as they ought to have been, nothing could have hurt them, but for want of such braces they are not only in danger of falling themselves, but are likely to throw down the gable of the nave and both crosses, as is nearly the case at present with the north end of the great transept (BL Add MS 6761, f. 73v).

This was a problem noted by Wren in his survey of Salisbury cathedral where he devised a scheme for restraining the west end of the roof, although any problem there that survived into the eighteenth century was solved by Francis Price's extensive reroofing of the cathedral.

Common rafter roofs, however framed, are inherently unstable and during erection some temporary bracing is necessary to keep each frame upright as it is erected. In his book on medieval building Salzman reproduces an illustration showing diagonal bracing on a roof waiting to be tiled (Geneva, Bibl. De la Ville, MS. 79, f.202 v.- reprinted in Salzman 1997: 208 plate 14). A recent photograph of a roof at Lincoln clearly shows that longitudinal timbers were nailed to the collars of the frames as they were erected and then subsequently cut away (Simpson and Litton, 1996: 204 - in spite of the tile of this article, these long timbers were not dated so perhaps assumed to be modern). Presumably medieval carpenters were prepared to rely upon the boarding on which the lead covering was laid to provide long-term longitudinal stability of these roofs, but this has not proved adequate, probably because of shrinkage of the timbers and/or loosening of the nails. The same photograph shows a long timber fastened across a large number of collars and Hewett shows such timbers in his drawings of the roofs. These were probably later modifications but have not been dated. Essex might well have added the long timbers across the collars but did no major re-roofing there. A plan by Foot *et al* dates the great transept roof to between 1700 and 1800 (Foot, Litton and Simpson 1982). However Hewett's drawing of this roof has a detail of the ironwork there that clearly indicates a nineteenth century structure (Hewett 1985: 74).

The reports to the chapters on the condition of Ely and Lincoln are slightly different in tone. At Ely he seems to have been interested in the effect on the soundness of the structure by the alterations that were made at various times. At Lincoln he seems more concerned with the effect of poorly conducted repairs. Both, of course, are problems that he set out in his preface to the Lincoln report.

Ely

Thomas Cocke observed that for Ely "it is surprisingly hard to describe Essex's repairs in detail"(Cocke 1979). We know from the account of Ely by Bentham that he reroofed the east end and Hewett has a drawing of this roof which shows a queen post arrangement with several timbers apparently dated 1768, and reporting that the tie beams are of pine. Although this is after Essex had effectively transferred his attention to Lincoln it is quite likely that these structures are to Essex's design. The problem is to know what he did with the wall at the east end. While racking of the original roof had pushed at least part of the wall out of plumb, Cocke suggested that only the upper part of the wall was rebuilt. However, he notes that a book published in the early nineteenth century claims that the whole wall was screwed back to the perpendicular as had been done at Beverly (Millers, G. *Description of the Cathedral Church of Ely*. Ely, 1807). Subsequently, and more recently, Dorman has said "After getting the East Front back into the perpendicular by means of screws Mr Essex constructed a fresh roof to the choir and Presbytery in what is known as the queen-post system, with enormous tie beams which stretch from one wall to the other" (Dorman: 1945). The description of the roof is correct but there is nothing in Essex's notes to suggest the major engineering work suggested by Dorman. All that Essex noted at Ely, and later in Lincoln, was the disruption to the masonry of the gable itself. At Lincoln he was to recommend just the rebuilding of the gable and unless further evidence comes to light, which seems unlikely, we may surely assume such modest repairs to the masonry were also carried out at Ely.

Essex's first observation at Ely was that:

> The great octagon tower is a very slight buil'^{g} but has been much assisted by ^{y} addition of timber work & other ties of iron, without which it could hardly stand. The spire on top of this octagon is [neither] useful nor ornamental but on the contrary [does] much disservice to the tower on which it stands and is in itself in bad repair as to ^{y} lead work (BM Add 6769 f.173).

This octagon was the work commissioned by Walsingham who, following the collapse of the central tower in 1322, set about extending the choir, building the

new octagonal belfry on top of the original Norman tower at the west end and rearranging the crossing piers, increasing the number from four to eight to support the timber vaulting over the crossing and the octagonal timber lantern above. The spire on top of the west tower was subsequently removed but whatever work Essex may have carried out there was subsequently lost in Giles Gilbert Scott's reworking of the tower in the nineteenth century, while that work also needed revisiting and the tower again strengthened in the twentieth century (Heyman 1976: 123–47).

Essex also commented on the poor condition of the lantern and set about strengthening it. Since then there have been a number of studies that give some clues to the nature of this strengthening and its possible effectiveness. Essex collaborated with Bentham in the latter's history of Ely Cathedral and, although that was not published until 1771, drawings in it, which were by Essex, include both long and cross sections of the building showing the framing of the lantern that Essex installed (Bentham: 1771). In 1974 Cecil Hewett discussed the construction of the lantern and produced a reconstruction of what he considered to be its original form (Hewett 1974). Then in 1985 Heyman and Wade published a structural analysis of the lantern structure (Heyman and Wade 1985). These different

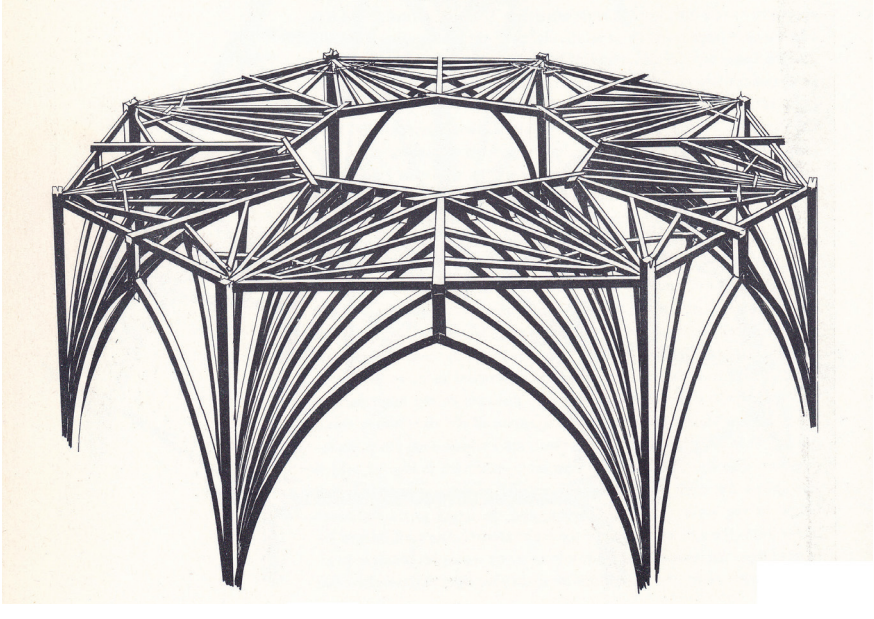


Figure 3
Drawing by Hewett of the 'floor' that supports the lantern at Ely

accounts of the carpentry took different starting points. The Bentham/Essex cross sections ignored the structure of the floor on which the lantern stands, as does the Heyman and Wade study. Hewett was interested in a three-dimensional picture pointing out that the elaborate floor structure must have been the first element to be erected and which was then supported by the curved ribs of the vaulting (Fig. 3). Hewett was concerned to reconstruct Walsingham's original structure, but he also considers to some extent the joining of the timbers which Heyman and Wade ignore. Sadly Hewett's drawings are not always reliable. His drawing on page 87 of *English Cathedral Carpentry* which purports to show the structure as it is today can only be described as fanciful (Hewett 1974).

Even a simple examination of the carpentry within the lantern today suggests that the eighteenth-century carpentry is still there. The diagrammatic layout of the timbers shown in Figure 4 is an adaptation of the figure in Heyman and Wade's paper comparing the Walsingham and Essex structures. Essex removed the posts against the wall which he found to be rotten. Neither the Bentham/Essex drawings nor the Heyman and Wade diagram distinguish between different timbers that join to the lower sill and the curved braces where-

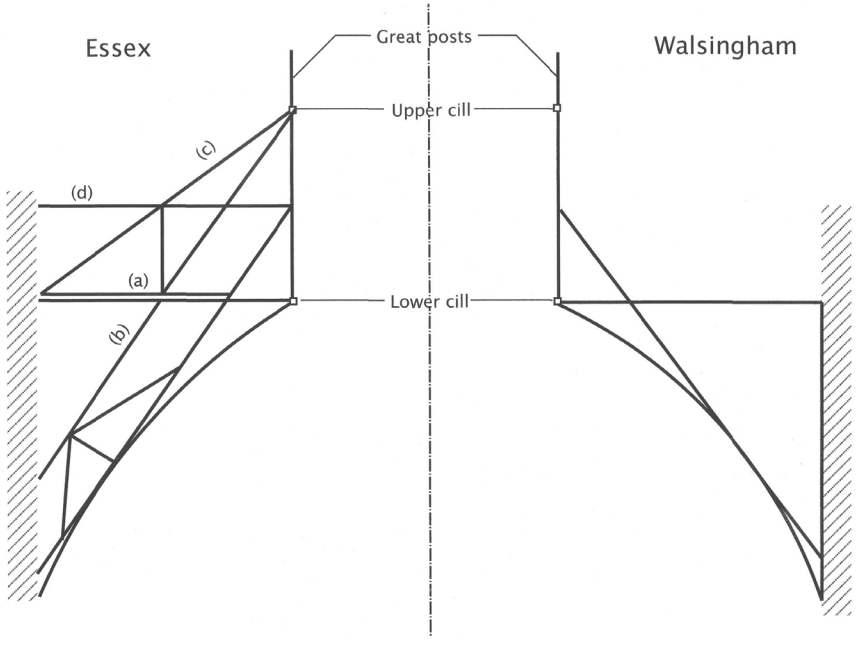


Figure 4
Diagram of the Walsingham lantern structure (right) and the Essex structure (left)

Figure 5
Timbers added by Essex above the medieval floor and up to the Walsingham brace (photo D. Yeomans)

Figure 6
Essex brace and the Walsingham brace clasped by Essex's timber 'd' (photo D. Yeomans)

as in fact Essex began by laying horizontal timbers, marked 'a' on the diagram, over the timbers of the original Walsingham floor. These timbers extend as far as the long brace of Walsingham's structure (Fig. 5) and it is into these timbers that the braces and additional posts have been joined. Essex's first laid timbers butt against Walsingham's long brace, which he seems to have reinforced. The brace marked 'b' is formed in two lengths with the upper part footed onto the post (also seen in Fig. 5). The upper beam 'd' is of three pieces, two clasping both inclined struts b & c while I then reduces to a single timber that joins the main post at the same point as the Walsingham brace (Fig. 6). There can surely be little doubt that these are Essex's timbers, which Scott left in place when he reworked the lantern.

The weakness of the original structure has been demonstrated by Heyman and Wade where they compare the original structure with that after the Essex strengthening measures. A major weakness of the original structure was that the curved ribs providing support to the floor would have been in bending. Members in bending are highly stressed compared with timber's ultimate stress and so offer little safety factor against decay. However, that would not necessarily have been Essex's major concern. It seems likely that Essex provided his braces b and c to carry wind loads, compensating for the external buttresses that he removed. Given his extensive comments on defects in the lead work he probably saw the lead flashing that those buttresses required as an unnecessary source of future problems. Unfortunately, it is not possible to see clearly how his braces attach to the main posts of the lantern. Scott's approach was to restore its original appearance and so he reinstated the external buttresses that Essex had removed but left Essex's timbers in place.

Lincoln and its Chapter House

Essex would not have had great difficulty in viewing the roof at Ely as it was at that time open, the present timber ceiling being a Victorian creation. However, at Lincoln he was working above vaulting and today it is difficult to imagine the poor lighting conditions that he had to work in, something that he commented on. He said in the Lincoln report that '. . . the darkness of the roof prevents ^{y} viewing of many parts of it'. He must have used a lantern of some kind but it is difficult to see how he could have made any kind of notes while using a lantern inside roof spaces. Indeed, as there is no indication that he made these surviving notes 'in the field', we are left to speculate as to whether he was able to simply remember what he saw or used some intermediate notes which were then discarded. Perhaps it is that which explains the two visits the first to make preliminary observations and the second to check what he had recorded.

On the racking of the roofs he says:

> The roof over the north end of ^{y} great cross is very bad; here the rafters have run from ^{y} perpendicular and by pressing hard against the gable end have forced that out of perpendicular likewise.

And in respect of the masonry he says:

> The north gable end of the great transept being very much pressed by the roof is fallen so very far from the perpendicular that it is absolutely necessary to take it down and rebuild it, being too much shattered to admit of any other method of setting it upright (BL Add Ms 6761 f.78).

Essex made extensive notes on the vaulting in his notebook but what concerned him most in the report was the way in which the vaulting had been treated by the carpenters. He notes that in making repairs to the roof the carpenters had in the past seen fit to regard the vaulting as a useful support:

> As this roof is so framed that more than 2 thirds of the rafters act upon the walls in the same manner as the vault itself, these cross beams were intended as tyes to keep in the walls & to prevent their pressing upon ^{y} vaults, care was taken to hang them up to the great collar beams by two posts, But as these lost their hold by length of time, blocks of stone or wood were injudiciously put upon the top of the vaulting to support the beams, by this means they are become a burden to ^{y} vault instead of tyes to the walls: I should therefore advise that in all parts of the roof, the beams be restor'^{d} to their original use by hanging them to the collar beams as they were at first & to hinder the raft-

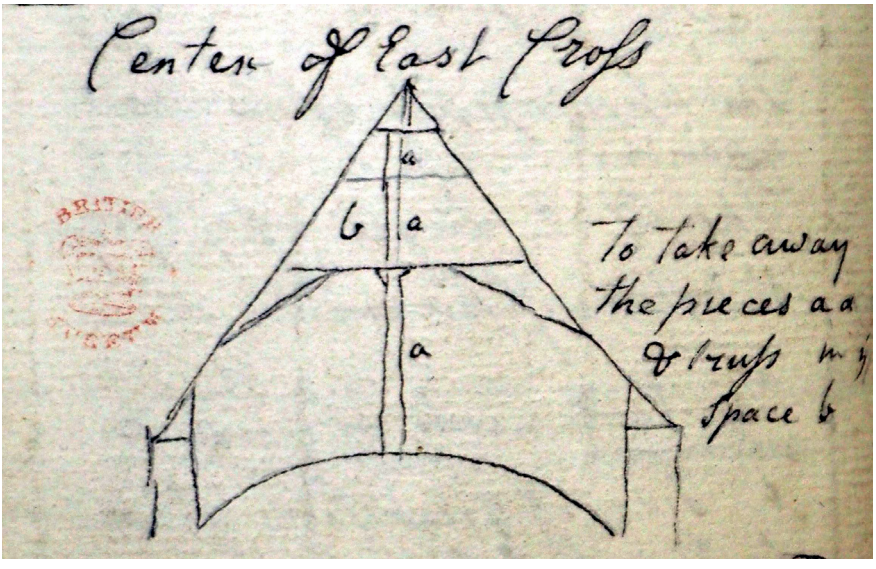


Figure 7
Sketch to show the propping of the roof from the vault at Lincoln. (BL Add. Ms. 6769, f.132.)

> ers from running, braces should be place'd under the rafters, so as to press upon the ends of the beams & not upon the middles of them, or near it, as many do now (BL Add Ms 6761 f.74v).

He included a sketch of the roof showing the support to the timbers provided by propping from the vault (Fig. 7). The posts here must be a later insertion although it is not clear from what Essex says whether it was something that he saw on first visiting the church or something added by the carpenters during repair work in his time and noticed in a subsequent visit to look at progress of the repairs he had recommended.

Anyone who has been into the roof of one of these cathedrals will be aware that the vaults are quite strong enough to walk upon but Essex disapproved of the fact that the carpenters seemed to regard them as a working surface, presumably from the evidence of chippings on the vaulting.

There is a worked-up example of this sketch included in a report to the cathedral dated August 1764 and it is clear from that that Essex was revisiting the cathedral to check up on progress of the work (BL. Add Ms 6772, f.271v). He comments on some lead work that either it has not been done or if it has been done it has not been done properly. It is not clear from the surviving papers how frequently he made such visits.

The report on Lincoln Cathedral contains a rather laconic comment on the roof of the chapter house. He simply says:

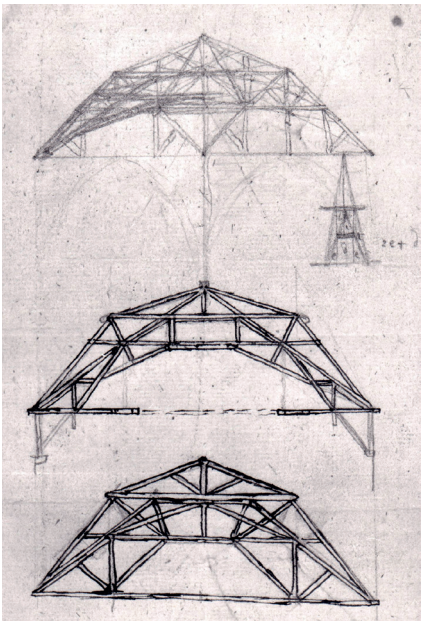
> The roof of this building is very bad both in timber and lead work, and unless soon secured will do great injury to the vaulting. But as the whole must be stript I think it would be better to take down the roof & lay it flatter, which will answer ʸ purpose full as well & save timber as well as lead. Surveyed September 1761 (BL Add. MS. 6761 f.79.)

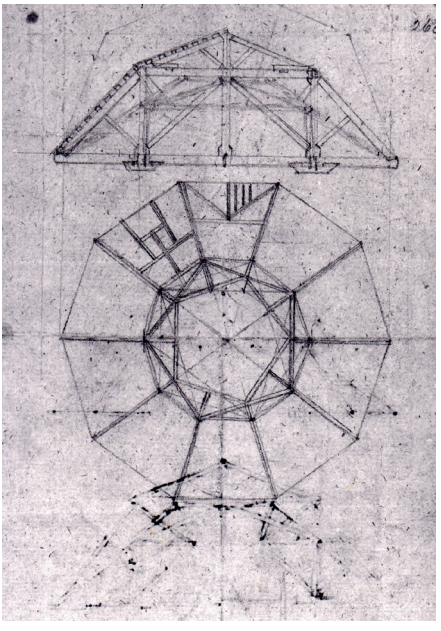
Clearly the saving of cost must have been a persuasive argument because his recommendation was adopted and a lower roof was built. Essex's papers in the British Library that deal with the design of the chapter house at Lincoln provide an insight into his thinking about structure because there is a letter stating his preliminary thoughts and a series of sketches that show the development of his design. This is perhaps a unique insight into structural thinking at the time. It is only unfortunate that Essex did not bother to make any record of the structure as he found it.

The chapter house is a ten-sided room with an outer diameter of 70ft. and a central column to support the vaulted ceiling. The walls rise to a little above the crown of the vaults. Essex rejected the possibility of using the central masonry column as a support for the roof because, as he explains in a letter, 'the stone pillar, tho' slender, bears as much of the vault as the walls', and so he was unwilling to bring the weight of the roof onto this already heavily loaded column. The initial development of the carpentry design is then explored in a series of sketches.

There is no difficulty in determining the sequence of his sketches. The first three are together on a single sheet of paper, one above the other (Fig. 8). On the back of this is a fourth, much more carefully made drawing, an interim design and not the one finally adopted. A separate sheet has a drawing that is a sketch for the final layout (Fig. 9) while a third sheet has a much more carefully drawn version of this at a larger scale (Fig. 10). Other pieces of paper bound into the same collection have sketch details of the carpentry. All this enables us to follow the development of his thinking.

Essex's first sketch (Fig. 8 top) shows a series of trusses spanning from the walls onto a central post that would have stood upon the central masonry pier. The post and the shape of the vaulting are lightly sketched in below the framing. What this sketch shows are a series of queen post trusses that would have come together at the centre, although one might imagine some crowding of the tie beams at the top of the post. What appears to be a king post truss then sits across the apex of the two queen post trusses in the





Figures 8 (left) & 9 (right)
The figures show the development of the Lincoln chapter house roof design. (BL Add. Ms. 2772, f.260.)

sketch, although clearly additional principal rafters would have been required. This is the idea that was rejected.

Sketched lightly over the top of this arrangement is a pair of arches springing from the same points on the wall but at the centre occupying the depth between the straining beams and the peaks of the queen post trusses. It is this idea that he developed as a series of straight timbers in the second sketch (Fig. 8 centre), although it is augmented by hammerbeams with brackets below them. As the brackets are in pencil and the rest of the sketch in ink they and other pencil marks could perhaps have been part of an initial idea rejected by the inked lines of the drawing. Essex shows that he was aware of the problem of outward thrust of the arch arrangement in the dotted lines suggesting tie beams across the centre.

The next sketch is a further development of this idea, first in pencil and then in ink. The arch is still apparent within the framing but with a clearly drawn queen post below it and a king post truss forming the upper part of the structure. In the next drawing which is on the back of this sheet (Fig. 9) the queen post truss has taken over completely and has been worked out in more detail. Only on this sketch is there any hint that Essex might have preferred a different shape be-

cause he has feint lines indicating a steeper lower slope and a higher roof. The plan on this drawing shows how he began to think about the tie beam problem, a problem that he had set out in his letter.

> In all kinds [of roof] some tye is necessary to keep [the rafters] from spreading and in those where they can be carried across without intermission it is certainly best to do it but this cannot be done because wherever the principals intersect the ties must intersect likewise. The roof having ten angles requires five pairs of principals . . . therefore if these tyes had to run through they would all cross in one place which could not be without much cutting and framing- Letter dated 11th June 1762 (BL Add. 6772 f 280).

What Essex is clearly proposing in this plan is some form of tension ring into which the truncated tie beams, or hammerbeams would frame. There was hardly anything new in tension rings; masonry domes had relied on tension rings for a long time, either iron chains or even timber chains. But chains had not been used in carpentry before. Moreover, here the ring is within the structure rather than outside it, as in a dome. Essex used short hammerbeams extending just beyond

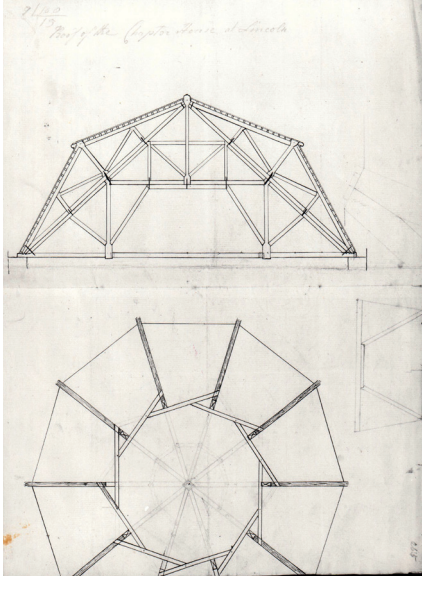


Figure 10
The design of the Lincoln chapter house roof with a well-developed ring structure

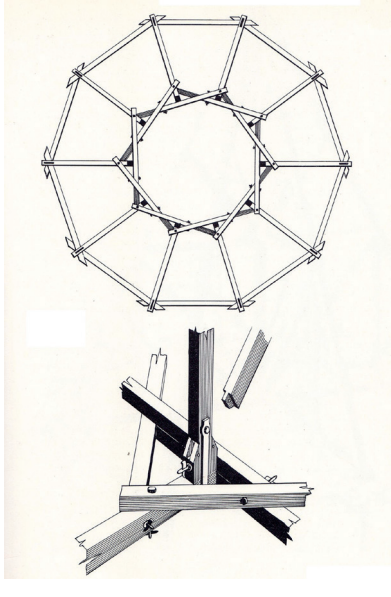


Figure 11
Hewett's drawing of the Lincoln chapter house roof tension ring and detail of connections

the queen posts and connected them to a tie ring of overlapping timbers. But in this first appearance of this idea the form of the ring is rather complex; something simpler was required. This appears in the next drawing where a very simple form of tension ring is sketched, taking almost the final form adopted, which was nicely recorded in Cecil Hewett's plan of the roof at tie beam level (Fig. 11).

The much simpler arrangement on this final sketch, or at least the final one that we have, is a clear improvement on earlier designs but clearly the arch had still been influencing his thoughts because it is sketched lightly over the drawing of the much deeper truss on the previous drawing. Here the lack of quantitative methods seems to have let Essex down because he did not realize that the deeper the truss the lower would be the forces in the members so that reducing the depth of the truss, making conform more closely to his sketched arch, he unwittingly increased the forces within the members. This development has also been presented as if one idea followed logically from the previous one, but anyone in-

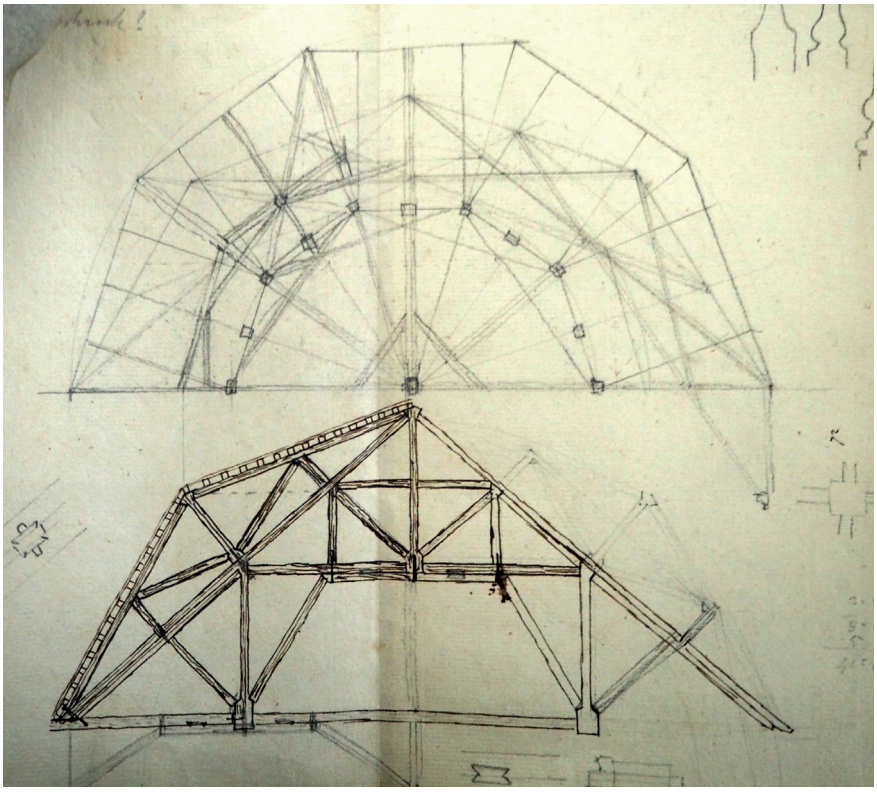


Figure 12
A design for the Lincoln Chapter House roof. (BL Add. Ms. 2772, f.262v & f. 263.)

volved in design knows that such a simple linear development seldom occurs. There is another sketch in the Essex papers that is difficult to put into this sequence and shows a rather more complex arrangement for both the cross section and the plan (Fig. 12).

Of course, just as tie beams of five queen post trusses would have to intersect without the tension ring being used, the compression chords of the trusses must also intersect, and bringing those and the rafters together would hardly be a simple matter. There are no surviving drawings to show how that was to be contrived. The carpentry here is very complex, difficult to see and even more difficult of access to inspect. Figure 13 shows the timbers where the compression chords of the queen post trusses come together. It seems that the compression chords were clasped by pairs of timbers above and below them with the lower timbers supported by struts some of which come from a central post. It seems

Figure 13
The junction of the upper chords of the queen post trusses at Lincoln chapter house (photo D. Yeomans)

that despite Essex's desire not to use a post standing on the masonry pillar which was supporting the vaulting he eventually had to resort to such a post to support the junction of the compression chords and the rafters. However, this was presumably carrying no more than the weight of these timbers.

There was also the problem of supporting the rafters where they met at the top of the king post, a problem made more complex by the fact that there were ten pairs of these rafters. For this connection we have the nearest thing that we

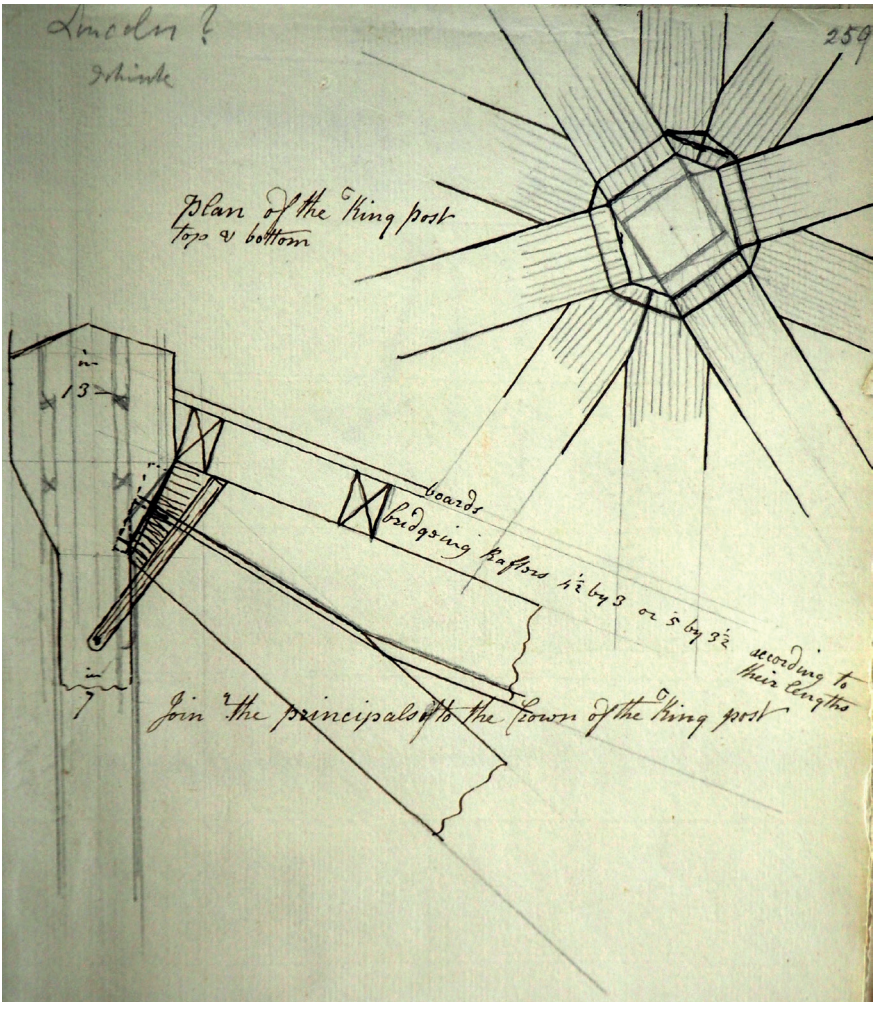


Figure 14
Detail for the head of the king post at Lincoln chapter house. (BL Add. Ms. 6772, f.259.)

have to a working drawing (Fig. 14). It seems that only four of the pairs of rafters were to be tapered and joined together by being tennoned into the head of the posts, but it is not clear from the drawing how the other timbers between them were to be handled. Again, it is very difficult of access to see exactly how it was constructed. Presumably Essex would have discussed the design as well as the process of construction with his carpenter Thomas Lumby who he recommended to the Bishop for this work (Cocke 1986: 152). But if Essex was prepared to produce a working detail like this we may surmise that he did so for other details of the structure to be used by Lumby and which were subsequently discarded.

Although the Essex structure for the Chapter House has survived, the outward shape of the roof that he built has not and Hewett's drawing shows the structure today (Fig. 15). It seems that the citizens of Lincoln were unhappy with the new shape of the roof and eventually additional timbers were added to restore the steep pitched form of the original roof as shown in the Hewett drawing which distinguishes the Essex structure from the additional timbers simply laid over it.

Clare College Chapel

Apart from the restoration work at Ely and Lincoln the other major carpentry work by Essex is the roofing of Clare College Chapel, Cambridge, where there is the framing of the roof and lantern. The chapel was designed by Sir James Burrough, an amateur architect, but completed by Essex after Burrough's death. The features of the design that required some carpentry design that Essex must have provided are the roof framing and a lantern at the east end. Access to these timbers is extremely restricted but a 'draft survey' has been carried out by Luka Pajovic. The roof structure is squeezed between a vaulted ceiling and a low-pitched roof concealed behind parapets and is essentially an arch like structure (Fig. 16) but it has not been possible to inspect the jointing of the timbers. Similarly, it has not been possible to provide jointing details of the dome and lantern framing where there is falsework for a plaster dome below the structural frames that support the lantern (Fig.17).

Domes with lanterns were nothing new. There is one by Hawksmoor at Greenwich Hospital for example. Here the structure of the lantern might well be compared with that of the dome and lantern of the Radcliffe Camera because a drawing of its structure was published by James Gibbs (1747). The structural problem was very similar, a plaster 'dome' rising above the wall plate with a lantern above. The structure that Gibbs used was based on a series of struts from each side across the diameter of the dome with these supporting a queen post truss; the lantern stands on the queen posts. Gibbs's drawing is

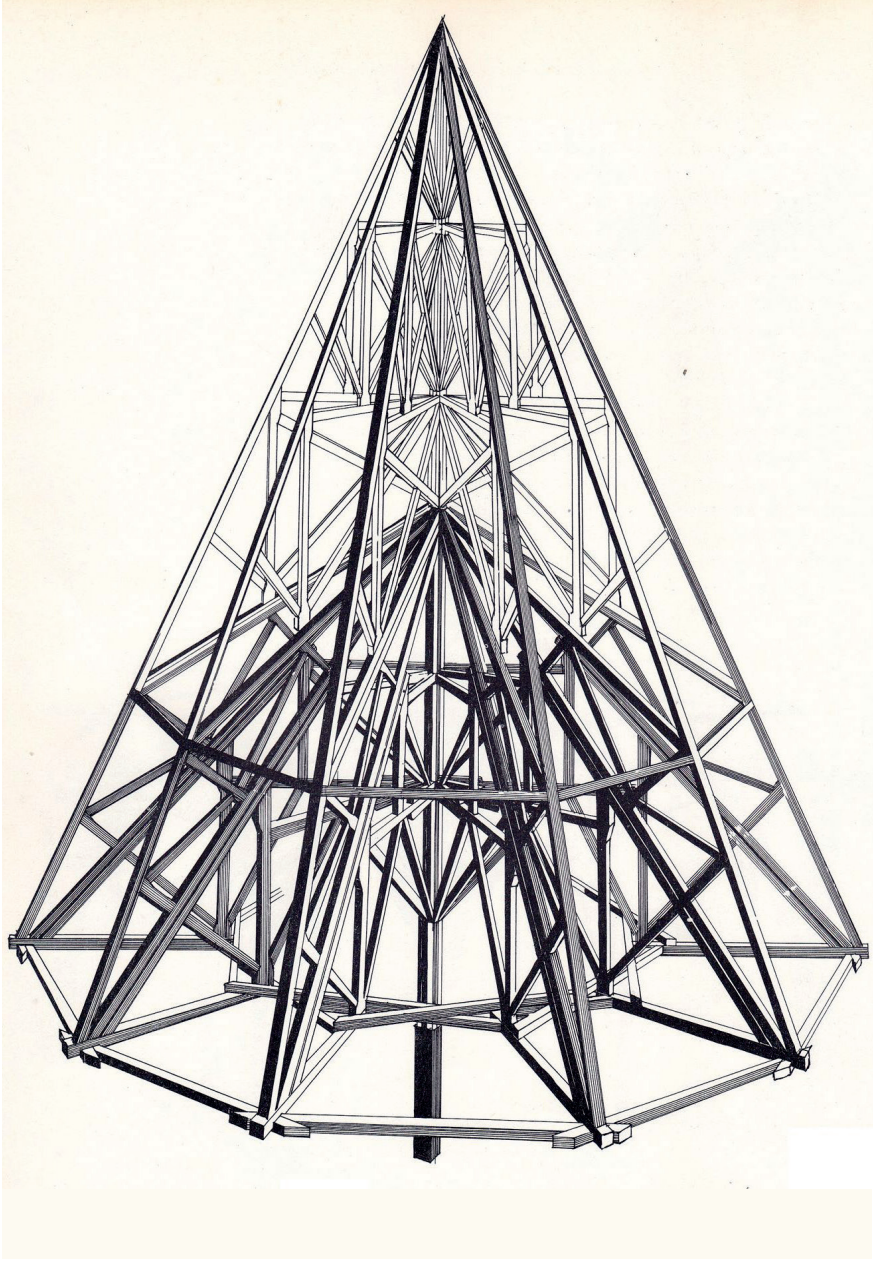


Figure 15
Drawing by Cecil Hewett of the Lincoln chapter house structure today

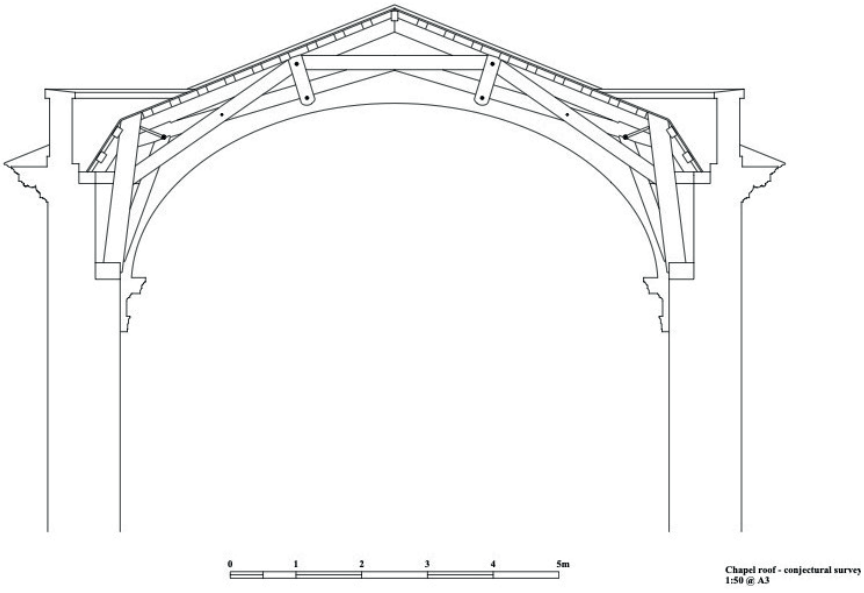


Figure 16
Clare College chapel roof framing (Drg. by Luka Pajovic)

not a complete description, but Essex does not seem to have considered this approach. Instead, he has major struts from the wall that frame into queen post trusses on either side of the lantern with other members framed into this arrangement.

Conclusion

From his reports on the cathedrals at Ely and Lincoln we see Essex as a competent surveyor making sensible remarks on the condition of the building. In the report for the latter, now in the local archives at Lincoln, there are notes added of the dates when his recommended works were carried out. His chapter house roof may have ultimately involved more complex carpentry than his original design ideas suggested but his desire to avoid a central post that carried much of the roof weight onto the masonry column in the centre of the room was a sensible intention. His tension ring structure shows considerable ingenuity. At Ely he provided sensible bracing to resist wind loads that Scott was content to leave in place and although in both buildings later work was carried out to restore the original appearance of these structures his pragmatic approach to them as build-

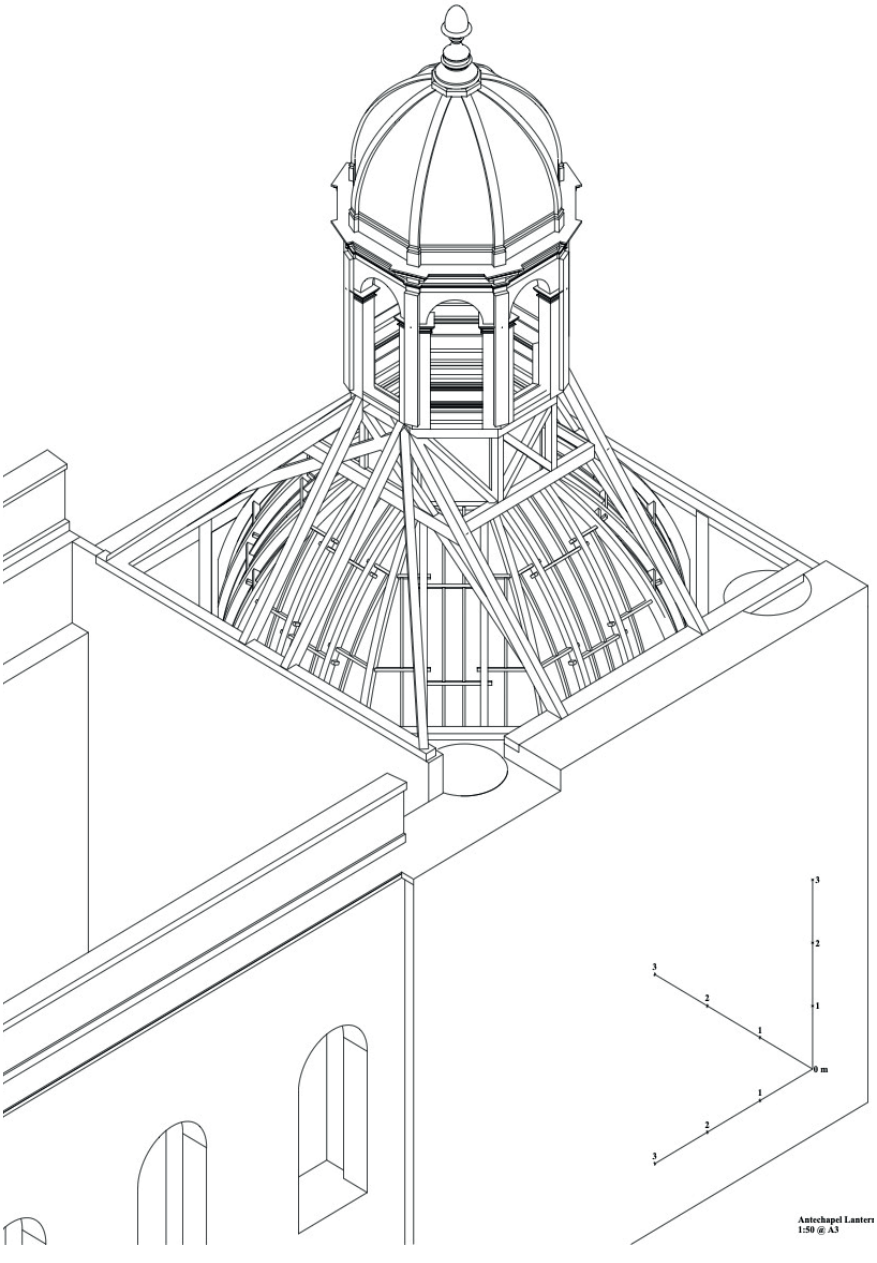


Figure 17
Clare College chapel. Framing of the lantern (Drg. by Luka Pajovic)

ings surely made economic sense in one case and concern for long-term reliability in the other. His works in these buildings are rare examples of carpentry applied to solve unusual structural problems.

What we do not know from either his writing or the examination of these structures is how Essex thought about structural behaviour. Newton's ideas of action and reaction might have been understood but it's not clear that everyone knew how to apply them in practice. And it was to be a long time before the nature of the forces in beams was understood; only their deflection could be observed. That is presumably how carpenters came to believe in the effectiveness of trussing girders. And although we have only a single enigmatic drawing to rely upon Essex might well have had ideas about using such a technique at King's College Chapel. However, his comments in his notebook on the thrust of the vaulting at Salisbury shows a clear grasp of those structures. We can also see the clear use of arch analogy in the development of his roof for the Lincoln Chapter House so that it seems likely that this was the kind of thinking being more generally applied in his carpentry designs.

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James Essex and Cathedral Archaeology

Alexandrina Buchanan

"... a rag-bag of odds and ends of architectural observation, architectural mythology and sheer irrelevance." So wrote Michael McCarthy of Essex's papers in the British Library (McCarthy 1987, 171). Yet from Donald R. Stewart's article on Essex (1951) onwards, they have been recognised as including an unpublished "History of Gothic Achitecture in England", as well as materials for a history of King's College Chapel in Cambridge, antiquarian notes on Cambridgeshire churches intended for publication and the drafts of his published papers, which mostly appeared in *Archaeologia*, the journal of the Society of Antiquaries of London. According to Howard Colvin, he was "the first practising architect to take an antiquarian interest in medieval architecture, and his knowledge of Gothic construction remained unique until the ecclesiological movement of the early nineteenth century" (Colvin 2008, 362). Both published and unpublished materials repay attention, as expressions of the state of architectural knowledge in the second half of the eighteenth century.

This essay therefore aims to analyse how the study of architecture shifted from the traditional antiquarian and topographical foci on documented dates and patrons, derived from textual sources into a more archaeological approach, using the building itself as witness to its own history, focusing specifically on the role played by James Essex in the transformation of this study.

Background

Part of this story has already been told: the shift from literary to visual data has been discussed by Alain Schapp (1996) and Sam Smiles (2000) and numerous scholars have discussed in particular how the antiquary John Aubrey (1626-97), in his unpublished work on architectural chronology (Oxford, Bodleian Library, MS Top. Gen. c. 25), identified many of the key features of stylistic change, included the shift from round to pointed arches and the emergence of tracery (Colvin 1968; Hunter 1975; Fowles 1980-2; London 1984, 370; Parry 1995; Sweet 2004; Horsfall-Turner 2011; Williams 2016, 81-88). Aubrey's work was rediscovered in the 1750s and over the course of the second half of the eighteenth century the stylistic table was formulated, finally being given the terminology now familiar from Pevsner's "Buildings of England" series, by Thomas Rickman in 1812 (Sweet 2004; Aldrich 2009).

Essex knew of the existence of Aubrey's work: he wrote to Richard Gough (1735-1809), Director of Society of Antiquaries, in 1781 that he:

> recollected that, in the Life of Anthony a Wood, mention is made of a curious manuscript, but unfinished, among the manuscripts of Mr. Aubrey in the Ashmolean Museum, intituled, "Architectonica Sacra." If this is an antient manuscript, it may possibly contain something relating to Gothic Architecture; and, if it does, it may be worthy your perusal. I shall be very glad, if your time will permit, to have some account of what it contains. (Nichols, 1831, 291; see also BL Add MS 6771, f.226r)

Essex nevertheless went on to note that "If the specimens of Gothic windows, engraved by Perry, are part of the contents of Aubrey's 'Architectonica Sacra', it must contain a very imperfect account of Gothic Architecture" and added "I am persuaded something better might be done, which would be useful and entertaining; and, if it could be managed, I should gladly assist in forwarding it" (Nichols 1831, 291-2). His essay on round churches concluded by announcing "a work purposely intended to explain what relates to the various styles of architecture which come under the general denomination of Gothic," with the gloomy addition "if I should live to compleat it" (Essex, 1782). This was the aforementioned history of architecture Horace Walpole was keen that Essex should produce (Walpole 1937, 190, 208); nevertheless, Walpole was as pessimistic as Essex about the likelihood of its publication, writing to his friend, the Cambridgeshire antiquary, the Rev. Willian Cole (1714-82), in 1770 "it will never appear while I am in being" (Walpole, 1937, 204).

Essex's notes in the British Library form the basis for the project, but it was apparently never written up to publication standard throughout. Despite McCa-

rthy's negative assessment, and his suggestion that contemporary support for his project was insufficient —that Charles Lyttelton (1714-68), President of the Society of Antiquaries, preferred to support fellow churchman James Bentham (1709-94) and Horace Walpole had no confidence in Essex's historical scholarship (meaning knowledge derived from texts as opposed to knowledge derived from buildings) (McCarthy, 1987, 23), there was nevertheless recognition of Essex's particular expertise. In 1779, the Cambridge antiquary Michael Tyson (1740-80), who had been proposed by Walpole as a potential co-author with Essex (BL Add MS 6771, f.214r) and was familiar with their content, wrote to his friend Richard Gough,

> I cry when I think that Essex's materials must be lost to the world in a few years, and with them all real knowledge of that singular art; for no one alive understands the technical part but himself. Can't you beg, borrow or steal them? (Nichols 1814, 656).

Fortunately, Essex's papers passed to his wife's niece's husband and fellow antiquary Thomas Kerrich (1748-1828) and thus to the British Library, where they became a scholarly resource (Stewart 1950), whilst Kerrich provided posthumous publication of some of Essex's ideas on arches and vaulting (see Huerta in this volume) and his notes from his Continental travels were published by the Cambridge Antiquarian Society (Essex, 1888). It should nevertheless be recognised that these documentary survivals may not be fully representative of the skills of visual perception possessed by Essex and for which he was valued by his peers. There is also the likelihood that he had significant influence on his contemporaries beyond his published writings, although the evidence can be hard to trace.

We can infer from the published and manuscript correspondence that Essex was a prolific letter writer, and generous with his scholarship (e.g. Nichols, 1780-90, 1814, 1815, 1831). Through the Cambridge antiquaries and the Walpole circle (which intersected), he was connected to the whole antiquarian world, which although disputatious, was close-knit and mutually informative (McCarthy, 1987).

Essex's British Library notes reveal his visual acuity in relation to style, which informed his published work, though he was rarely forthcoming about the diagnostic features he associated with different styles (an exception is his correct identification of tracery as originating in the reign of Henry III, BL Add. MS 6762, f.35r) and he was perhaps wrong as often he was right. He was correct in his observations of Exeter Cathedral:

> Transepts of good Norman work but the rest of the building cannot be older than the beginning of Edward 1st unless the East Part was began in Henry 3rd time but the

> west front with the ornaments of Statuary is of later date probably about the end of Edward 3rd Reign. (BL Add MS 6770, f.7r)

and Norwich Cathedral:

> The Stile of the architecture in General is the same as the Churches of Ely & Peterborough which were built about that same time. (BL Add. MS 6768, f.56)

Conversely, he declared of the thirteenth-century east end of Ely Cathedral,

> if we may Judge by the architecture and manner of the vaulting I should suppose it was in the beginning of the King Stephens Reign or at the end of Henry the first. (BL Add MS 6764, f.14r).

Here, however, we will focus not so much on dating by style —where Essex perhaps lacked either the confidence or the terminology to articulate a framework for analysis— as in the other contributions he may have made to structural archaeology.

Essex and Cathedral Archaeology

Tim Tatton-Brown has identified modern cathedral archaeology as depending on a number of techniques: mouldings analysis, dendrochronology; study of masons' marks and carpentry; and below ground archaeology (Tatton-Brown, 1991, 74-75). To these should be added the study of masonry breaks and other evidence in masonry of the sequence of construction, previous structures and subsequent alterations, as well as the intellectual frameworks by which these data can be translated into evidence. Each of these has its own distinct history and Essex made a substantive contribution to several of them. However, because his publications were limited, and are often contributions to the work of others, his significance has not hitherto been fully acknowledged.

Essex made a particular study of King's College Chapel and other Cambridgeshire buildings; the cathedrals of Lincoln, Ely, and Winchester, and the ruins of Crowland Abbey and issues arising therefrom. He also made some study of sites further afield, including in Canterbury, although in relation to the cathedral he suggested, "the short opportunity I had of seeing it, did not furnish me with all the materials to support my opinion" (Nichols 1780-90, vol. 1, 472). Local historian William Gostling wrote to him in 1760 "They who have hitherto treated on our cathedral seem to have quite neglected the Consideration of the Structure, or to have been so unhappy in making their Observations that an Artist

[i.e. Essex] in a couple of Hours could see more of it than they ever had any notion of." (BL Add MS 6771, ff.217-220, quoted in Stewart 1950, 319). It therefore seems likely (but remains unproven) that many of Gostling's archaeological observations were informed by Essex's visit.

In order to understand what Essex added to scholarship, it is first necessary to explore his motivations —the questions that informed his research. The context too is important, as he tailored his outputs to the requirements of different audiences. His published research should be situated within the mainstream of antiquarian scholarship of the second half of the eighteenth century, when Gothic architecture was starting to become a subject of enquiry in its own right (Smiles 2000, 2002; Sweet 2004; Hill 2021). His unpublished reports (on Ely, Lincoln and Winchester) on the other hand, were written for the benefit of Deans and Chapters. They were trying to maintain fabrics often still suffering from the damage caused during the seventeenth-century interregnum, lacking dedicated resources for maintenance and without a clearly defined role. These were buildings which were too large for their congregations, often inconvenient for their clergy and designed for liturgical practices such as Marian devotion and pilgrimage rejected by mainstream Anglicanism. Essex thus had to steer a course between antiquarian reverence and the practical demands of those for whom medieval architecture had little to recommend it.

The search for origins

It is clear that Essex was particularly interested in identifying the original —or earliest surviving— fabric on a site and its intended plan. This was in line both with an antiquarian obsession with origins and with Anglican interest in the earliest manifestations of Christianity in England. Here, Essex's method was, as he put it in relation to Lincoln:

> comparing the historical accounts with the fabric itself; and from various opportunities I have had of examining the several parts of the church, and comparing them with the plans in Sir William Dugdale's and Mr. Willis's histories (Essex 1777a; Dugdale 1655-73; Willis 1742),

by which he was able

> to delineate one which will give a perfect idea of the original form and extent of this Cathedral, and explain the several alterations and additions that have been made to it at different times. (Essex 1777a)

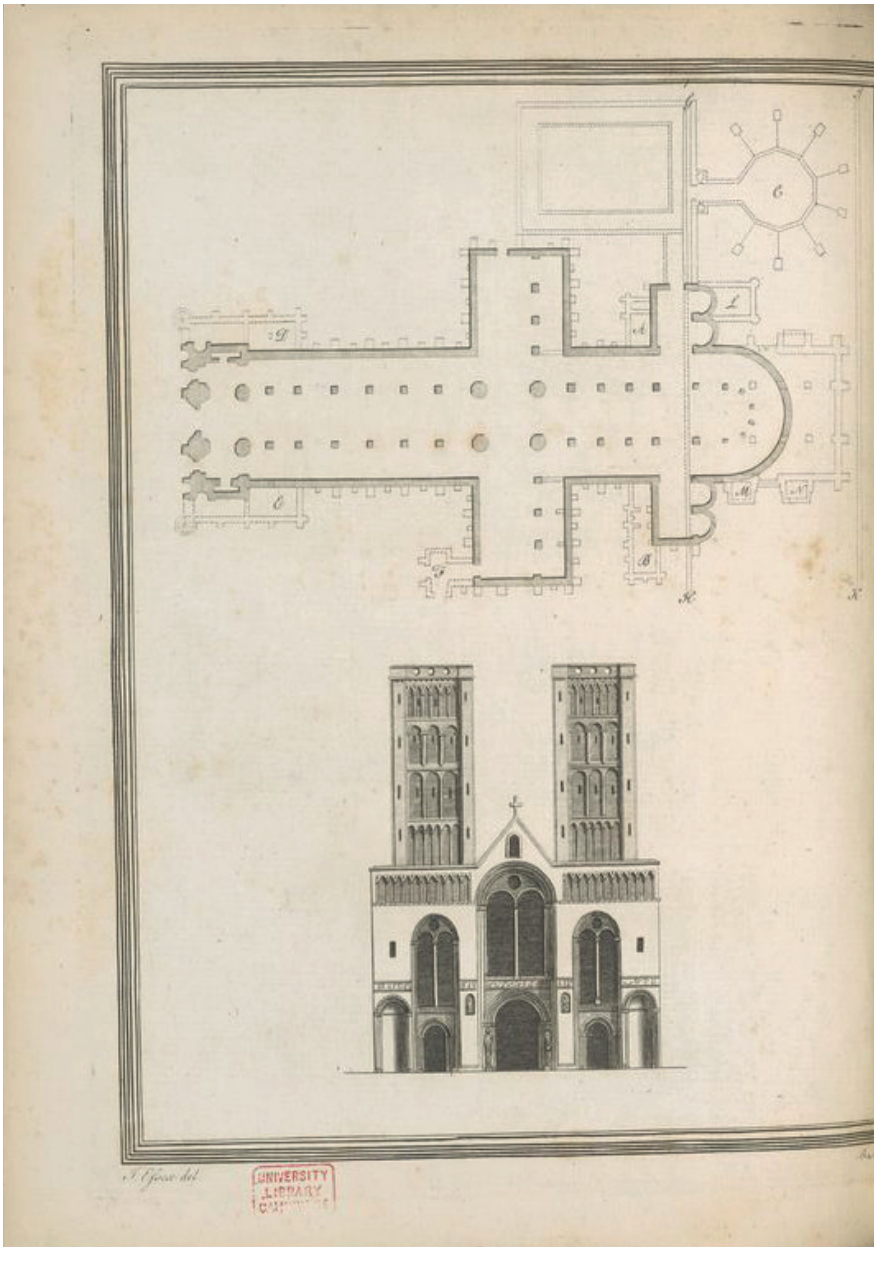

Figure 1
James Essex, plan and west front of Lincoln Cathedral, from Essex 1777a (Reproduced by kind permission of the Syndics of Cambridge University Library).

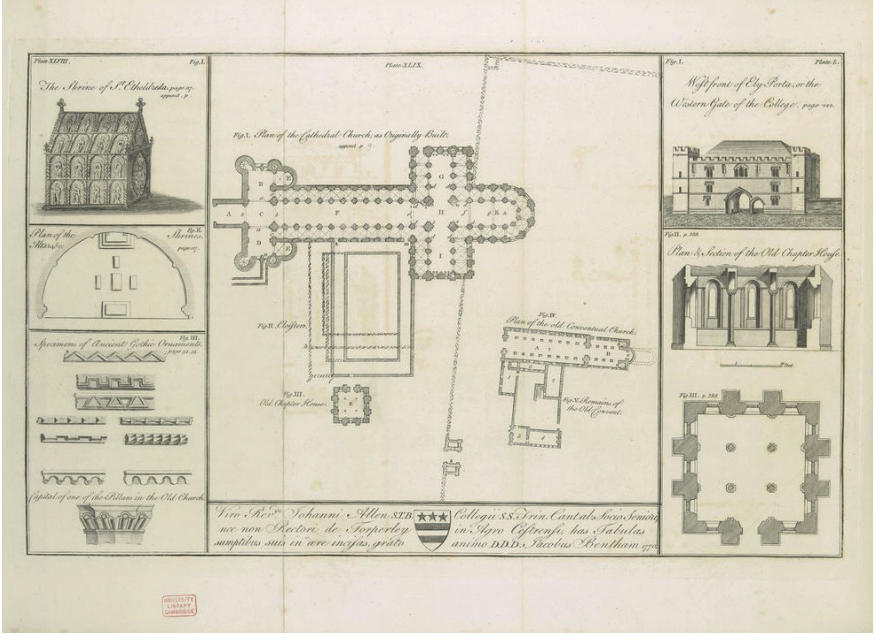

Figure 2
James Essex, plan of Ely Cathedral, from Bentham 1812, plate XLVIII (Reproduced by kind permission of the Syndics of Cambridge University Library).

He adopted the same approach at Crowland, first listing the patrons and their works as described in the abbey chronicles and

> By comparing this account with what remains of the building itself, we shall be able to form some judgement of its extent, and may trace very nearly the original form of it. (Essex, 1783, 188)

Thus we have plans drawn up by Essex for the cathedrals of Lincoln and Ely and Crowland Abbey (Figs. 1, 2 and 3), all suggesting designs which either no longer survived or were not visible above ground. His interest in Canterbury Cathedral also seems also to have focused on identifying the form of the building preceding the fire of 1174 (Nichols 1780-90, 470-72).

Although Essex implied that his method was a triangulation of literary and physical evidence —for which his is an early, but not unique claim— there is little in the textual evidence to support the exact forms he proposed. In all the above cases, the plans he set out were plausible, but do not correspond to the plans as currently understood, based on physically surviving evidence, mainly

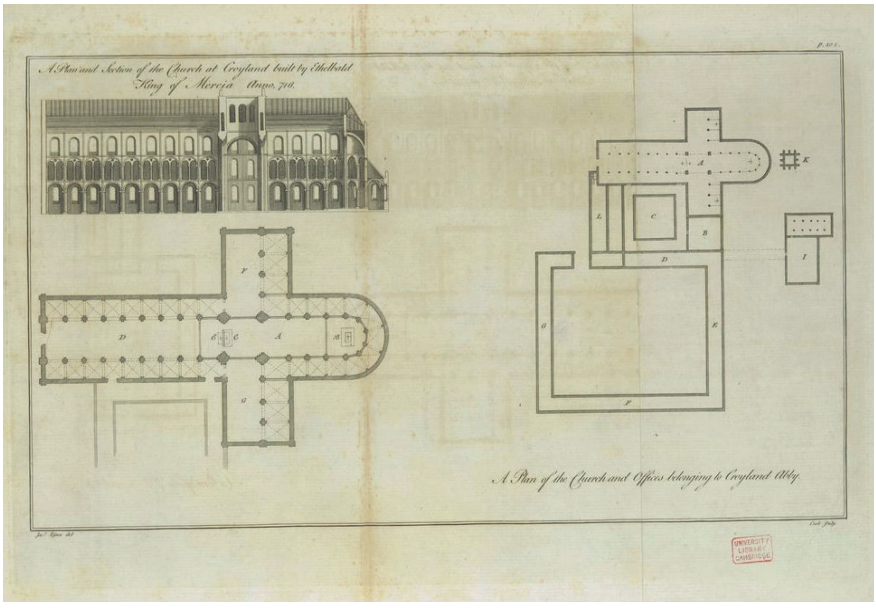

Figure 3
James Essex, plan of Crowland Abbey, from Essex 1783 (Reproduced by kind permission of the Syndics of Cambridge University Library).

exposed through excavation. It seems Essex believed that Norman abbeys were standardly of cruciform plan, with an apse and ambulatory plan but without projecting ambulatory chapels. He also proposed this design for the Saxon church at Crowland and claimed it as an early example of the arrangement, on the basis that the Saxon church at Ely (of which more later) was a simple parallelogram with single apse at the east end (see BL Add MS 6776, ff.47r-57r). In relation to Crowland, he claimed that the design had been copied at Peterborough Cathedral, a building he knew well, where the hemicycle piers survive as part of the modified fabric. The elevations of Peterborough (and Ely) are also a good comparison for what he proposed for Crowland (Figs. 3 and 4).

At Winchester, Essex noted:

> the extent of the Cathedral at Winchester as it was first built may be seen in the vaulting under the Choir called the Crowds or undercrofts. The east end was semicircular + had 5 arches, the ailes were continued around it, at the end was a Chapel as at the abby church in St. Edmunds Bury, but the extent of it I could not examin being lockd up + used for a wine Vault. (BL Add MS 6768, f.237; his reconstruction of the Norman cathedral plan is at BL Add MS 6770, f.13r)

Figure 4
Elevation of Peterborough Cathedral choir.

This shows awareness of an ambulatory (as proposed for Crowland) and axial chapel (as proposed at Ely), as well as the possibility of comparative study - but no mention of the other ambulatory chapels, although admittedly at Winchester these did not radiate, unlike those at Norwich and Gloucester, which he also knew (for Norwich, see BL Add MS 6768, f.55). It would therefore appear that in proposing plans, Essex used a method of comparison based on a limited range of personally known examples. He never seems to have initiated excavation, although he distinguished parts of the plan that were traceable at Denny and parts which could only be inferred (Lysons 1808, 273-4), whilst at Crowland he did make efforts to examine the hollowed-out trenches where foundations had been removed, and spoke with a labourer who reported what he had found when excavating stone from the site (BL Add MS 6772, f.92r). This led Essex to suggest that the east end had been based on wooden rafts rather than piles (Essex, 1783, 189). Using the measurements of the cavities, Essex suggested the dimensions of the former east end and in doing so both contradicted the claims made by Browne Willis (1682-1760) and offered an interesting methodological claim: given the “known measures of a few parts” he said

> we may ascertain very nearly the form and dimensions of the whole; as Vitruvius, from knowing the breadth of a single trigliph, could determine the dimensions of the temple it belonged to; that is, from the breadth of a trigliph he could know all the measures of the order it belonged to; and, knowing the figure and aspect, or number of columns in the front of the temple, he could tell the dimensions of the whole. (Essex 1783, 190)

Throughout his analyses of medieval architecture, Essex was willing to attribute to the designers a much more principled approach than had hitherto been acknowledged. As he put it:

> if any one, who is properly qualified, will divest himself of his prejudices in favour of the mode of building which fashion has made agreeable, and impartially examine the merits of those Gothic buildings, he must acknowledge, that the ancient Free-masons were equal to our modern architects in taste for designing (agreeable to the mode of their times), and superior to them in abilities to execute; that they perfectly understood the nature and use of proportions, and knew how to vary them when they wanted to produce a striking effect. (Essex 1777, 159)

He was also very complimentary about medieval understanding of structure: as he put it in relation to Crowland:

> the free-masons in those days knew what foundations were proper for every soil, and how to proportion the depth and breadth of a foundation to the weight of its superstructure, and the nature of the ground they had to build upon; and they were so frugal in the use of their materials on these occasions, that we seldom find piles, planks, or other materials, unnecessarily used, and as seldom see any failure the largest or loftiest of their buildings occasioned by any want of solidity in their foundations, although many of them were erected seven or eight hundred years ago, and some of them on very precarious ground. (Essex 1783, 189-90)

This is a somewhat over-generous assessment given his knowledge of the collapse of the crossing towers at both Lincoln and Ely, but supported his claims as to the principled basis of medieval design.

Monastic planning

At Crowland he also proposed a plan of the monastic buildings (Fig. 3). This shows some awareness of the typical location of key offices such as the chapter house and the cloister but is less accurate, either topographically or in terms of identifications, than Lincolnshire antiquary, the Rev. William Stukeley (1687-

1765) in 1747 (Gresley 1855). Essex wrongly proposed a form of second courtyard to the south of the cloister, around which he located offices which later scholars would associate with the cloister proper (such as the refectory and dormitory) but he also demonstrated particular concern for more mundane functions, such as a shoe-maker's workshop, the brewhouse and beer cellars, and also located the infirmary and chapel and the almonry. These are suggestive of a more eleemosynary interpretation of the monastery than was typical at the time, with no mention of either a library or a prison, which were often (wrongly) identified with specific locations within monastic sites. Essex shows precocious awareness that conventual plans followed the same general arrangements and noted:

> it is much to be wished, that plans of other great monasteries, where any considerable ruins remain, were taken before they are quite destroyed, as they may some time or other serve to illustrate the accounts we meet with in our antient ecclesiastical writers, which are not clearly understood without such helps. (Essex 1783, 202)

He suggested that the monastic remains at Canterbury, both those of the cathedral and of St Augustine's Abbey were particularly deserving of "an accurate and critical survey" (Essex 1783, 202). He also thought that although difficult, it might not be impossible to excavate the remains of Glastonbury Abbey, including the offices (BL, Add MS 6770, f.5v). It is clear from Richard Gough's notes (Bodleian Library) that this aim was shared; moreover Essex's fears about loss were founded in fact: the rapid expansion of towns in the late eighteenth century led to many urban monastic sites being redeveloped, whilst those in rural areas were subject to being redeployed as picturesque garden ornaments.

Paper reconstruction

In terms of undertaking hypothetical reconstructions by notionally stripping away later work, Essex was pioneering in his visualisations of the original design of Crowland Abbey (Fig. 3), of the West Front at Lincoln (Fig. 1) and of St Sepulchre's, otherwise known as the Round Church, in Cambridge (Fig. 5). He said of Lincoln that he had drawn "the west front divested of the parts which have been added, and have restored those which have been altered; which will give a tolerable idea of that front as it was left by the first builders." (Essex, 1777a, 150) His proposed west towers are not consistent with the reconstruction proposed by modern architectural historians (Gem 1986; Fernie, 1999; Quiney, 2001), but are paralleled both by the later design of the west front at Lincoln and by other Romanesque examples, such as the abbey of St Etienne at Caen or Southwell Minster.

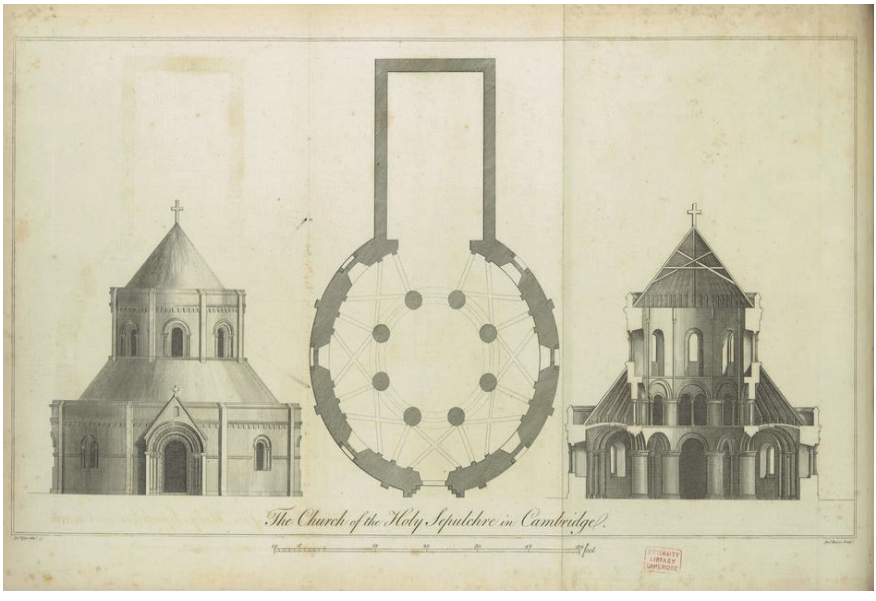

Figure 5
James Essex, elevation of the Round Church at Cambridge, Essex 1782. XLVIII (Reproduced by kind permission of the Syndics of Cambridge University Library).

His visualisation of St Sepulchre's looks, to the modern viewer, to have entailed little imagination —but what we are now dealing with is Salvin's nineteenth-century restoration, which clearly owed much to Essex's research (Miele 2010). The building as it existed in Essex's time looked very different and it is clear how acute and perceptive Essex's visual imagination must have been (Figs. 6 and 7).

In line with the interest in origins, when dating the surviving and reconstructed designs, Essex had a tendency to argue for an earlier date than architectural historians would now accept. Although he rejected William Stukeley's suggestion that Guthlac's cell at Crowland could be reconstructed, explaining that the remains Stukeley had seen were in fact apartments added to the west front in the fifteenth century (Essex 1783, 196), he nevertheless argued that the abbey church plan reflected its Saxon predecessor. His argument was supported by reference to textual descriptions of the church at Hexham (Northumberland), which were already a familiar trope in antiquarian scholarship (Essex, 1783, 201). He suggested that his plan of Lincoln, with its eastern transept, was the original plan laid out by Bishop Remigius after the Norman Conquest (Essex 1777a, 4-5), whereas we now know that the Romanesque building was on a much smaller scale (Bilson 1911; Kidson 1984; Gem 1986).

Figure 6
St Sepulchre, Cambridge, drawn by R.B. Harraden, etched by Elizabeth Bryne, published 1809, by R. Harraden & Son, Cambridge and R. Gribb & Son, London.

More accurately, he argued that the account of the burning of Canterbury Cathedral by the monk Gervase might have overstated that extent of the damage. Comparing the written account, published by the Society of Antiquaries, with the cathedral building, he wrote in a letter of 1760:

> Now I have some reason to doubt whether this account is altogether true; for by my observations it seems, that as much of the present choir as is comprized between the

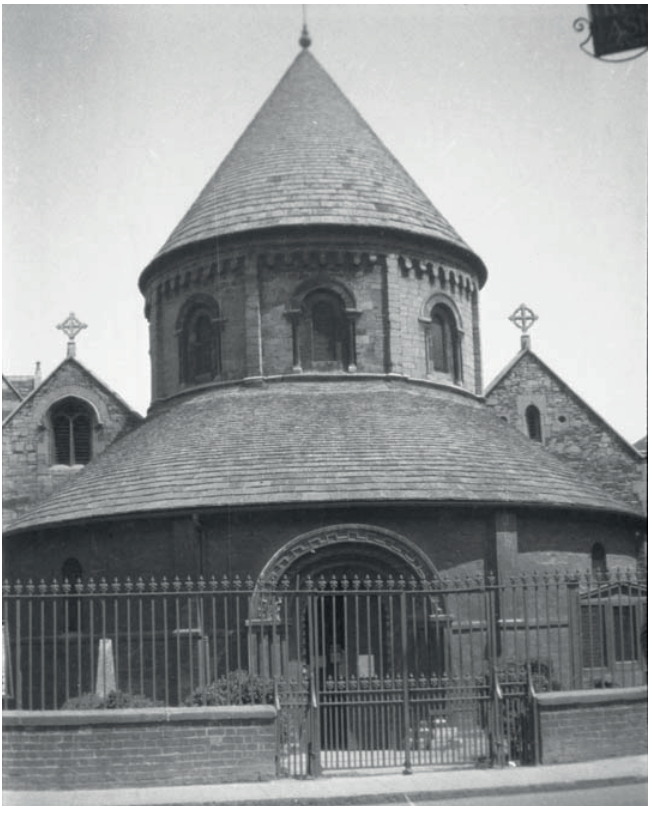

Figure 7
St Sepulchre Cambridge, 20th century (from Wikimedia Commons).

> great tower and the two little towers of St. Gregory and St. Anselm, is the greatest part of the original choir of Conrad, and that all the columns, if not all the arches above them, with the vaulting of the side ailes, as far as the east-cross, belonged to that choir. (recipient identified as Andrew Ducarel by Nichols 1780-90, vol 1, 470 and Gostling 1796, 79)

He was right that the side walls survived, but the inner columns and vaults are part of the post-Fire reconstruction. It is worth noting that he also highlighted a feature which no longer survives, wooden tie-beams across the entrances into the eastern transepts, which he attributed to William of Sens, the first architect of the rebuilding:

> the pieces of wood which have been fixed in those arches were tyes of his fixing to secure the work till the whole was finished, as the arches could not well stand without some such continuance. (Nichols 1780-90, vol 1, 472)

There is, however, no evidence that Essex supported Gostling's hypothesis that the surviving Romanesque fabric in the upper level should be attributed to Lanfranc's immediately post-Conquest church rather than Conrad's early 12th-century replacement. (Gostling 1774, 56-8, 143-6)

Saxon architecture

A desire to attribute fabric to the earliest possible date also infused Essex's study of Ely, where he concurred with James Bentham's identification of the infirmary chapel as the Saxon conventual church (Bentham 1812, 24-5, 29, 289, Fig. 8). In his unpublished notes, however, he was more circumspect, arguing:

> Tho the antiquity of this Church cannot be doubted, there is nothing in these remains by which we can exactly ascertain whether it is the same which was built by the Foundress in the seventh Century, or whether it was rebuilt when the Abby was founded in the tenth, or whether it might not have been built for the use of the infirmary after the present Cathedral was made fit for Use. (BL Add MS 6764, f.11r)

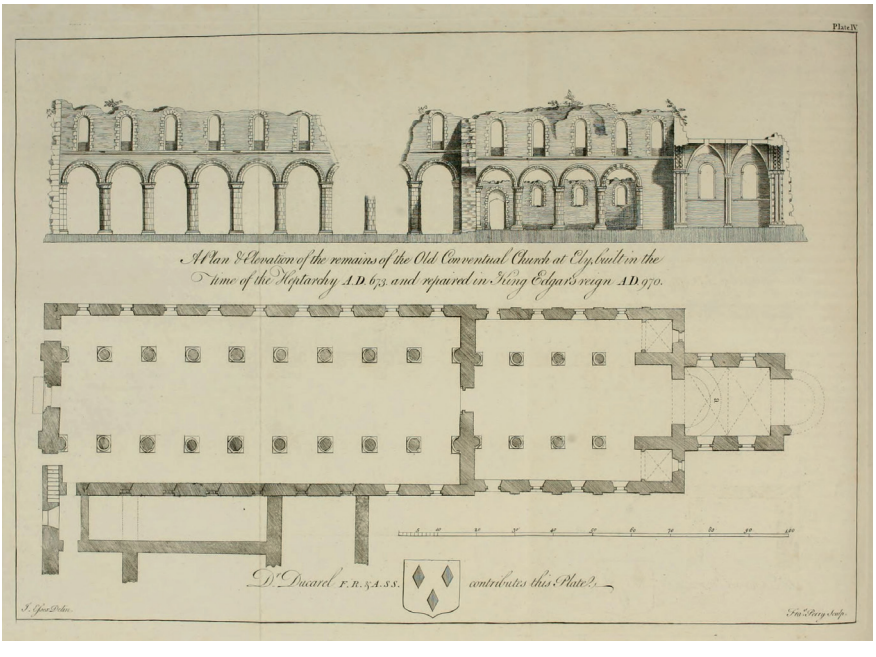

Figure 8
James Essex, elevation of "St Etheldreda's Conventual Church" (the infirmary), Ely (Bentham 1812, plate IV).

Figure 9
Ely Infirmary (copyright Ron Baxter, CRSBI).

The relationship between Essex and Bentham is the subject of scholarly disagreement: McCarthy implying that Bentham's 1771 book stymied the publication of Essex's own "History of Architecture" (McCarthy 1987, 23), whilst Frew suggested a more friendly relationship (Frew 1980).

The identification of the Ely infirmary as St Etheldreda's church would confuse the study of Saxon architecture for many years and probably contributed to Essex's misdating of the surviving work at Crowland. We should, however, not overlook the intellectual labour required to visualise the building as an unencumbered ruin, for the open arches depicted in Essex's view were by his date —as today— filled in with the facades of later houses inserted in the aisles (Figs. 8 and 9).

Nevertheless, Essex also proposed identificatory features of Saxon construction which were perceptive and long pre-date similar observations by Thomas Rickman (1833; 1835, 299-308). These include the observation of long-and-short work, which he both noted and named as such in the tower of St Bene't's church in Cambridge and the arcade of the parish church at Ickleton (Cambridgeshire), both accepted as Saxon buildings, and herringbone masonry (Fig. 10). He also proposed that the extent of use of Roman-style tiles and bricks in Saxon and Norman architecture suggested that techniques of manufacture had not been lost

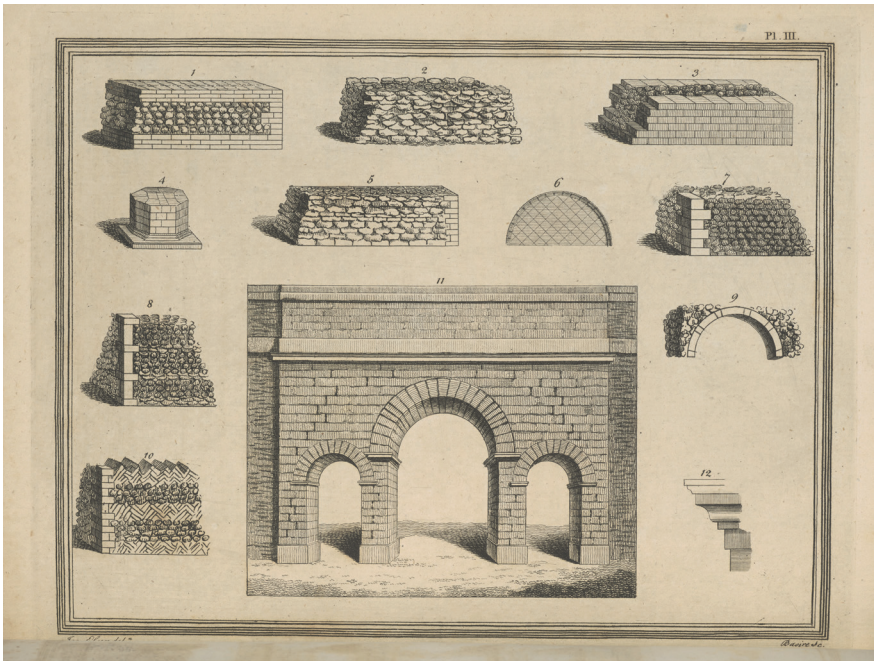

Figure 10
Medieval masonry, including long-and-short work (number 8) and herringbone (number 10), from Essex (1777b) (Reproduced by kind permission of the Syndics of Cambridge University Library).

and that some were of recent manufacture, rather than spolia (Essex 1777b). This suggestion has yet to be confirmed by modern scholarship but has not been ruled out either.

Although he did not use the term "Romanesque" (first introduced by James Gunn in 1819), he defined both Saxon and Norman architecture as being "after the manner of the Romans" (BL Add MS 6768, *passim*).

Masonry and the forms of foundations were a particular interest, again with a desire to identify what techniques were known in Britain before the Romans, what were introduced and what survived the fall of the Roman Empire. Most of the literary sources Essex used in his "Remarks on the antiquity and the different modes of brick and stone buildings in England" were already familiar to antiquarian scholarship, but Essex combined these with original first-hand observations. He was keen to distinguish absence of evidence from evidence of absence, for example he was wary about stating that mortar was unknown in "Ancient British" architecture simply because no

examples of its use had yet been found (Essex 1777b). He was also very aware of the difficulties of dating masonry by style alone but nevertheless proposed some useful landmarks, for example that the Normans rarely used soft and light stones such as rag except in the core of walls or vault webs; and that the styles of masonry changed in the mid-eleventh century, when the use of polished marbles, such as Purbeck and Petworth, was first introduced (Essex 1777b).

Structural analysis

Less visible from his published work, but fundamental to the unpublished "Report on Lincoln Cathedral" is an interest in cracks, both those deriving from inadequate engineering and those marking a chronological break (Essex 1761). This was one of his objectives, to differentiate the two in order to understand what remedies might be required. His description of how the lack of buttressing had caused the clerestory walls to spread outwards, resulting in a drop at the crown of the vault and cracks in the webbing running parallel to the side walls is astute and, as at Canterbury, he noted the former presence of wooden tie beams designed to alleviate spreading whilst arches were under construction (Essex 1761). These had already been removed by Essex's time but their stumps remain above the abaci of the main piers in St Hugh's Choir. He also noted cracks resulting from differential settlement between old and new work. There is, however, little evidence of an interest in constructional stratigraphy.

As Thomas Cocke observed, Essex "tried to investigate the structural logic of medieval building rather than to amass attractive details or curious historical fact" (Cocke 1985, 98). The constructional acuity of Essex's observations must be attributed to his architectural experience. Few of those most celebrated for studying medieval architecture had comparable knowledge and it is notable that those who did were most similar to Essex in terms of their professional experience. Sir Christopher Wren, in his "Architectonical Account" of Salisbury Cathedral of 1668-9, commissioned by his friend, Bishop Seth Ward, was one of the first accounts to recognise that the tower and spire were later additions to the thirteenth-century cathedral. (Wren 1965; Soo 1998, 61-78)

Salisbury Cathedral was also the subject of another early structural account, by the cathedral's clerk of the fabric, Francis Price (?1704-53). *A Series of Particular and Useful Observations made with Great Diligence and Care upon that Admirable structure, the Cathedral Church of Salisbury*, published in 1753, was described by Howard Colvin as "the first serious attempt to describe

and analyse the structure of a major Gothic building" (Colvin 2008, 829). This work was known to Essex (BL Add. MS 6768, ff.162-73) although he did not agree with all Price's arguments: he claimed (probably rightly) that the first architect had intended a crossing tower but, wrongly, that the bracing required by the tower and spire had been constructed from the start (BL Add MS 6768, ff.160-73).

Essex's survey of Lincoln was undertaken in much the same spirit as Wren's survey of Salisbury: an account in which the architectural and construction history of the building was provided as context for identifying structural problems needing remedy. It is notable, however, that the published version of the report reverses the priority and focuses on the construction sequence, with an emphasis on identifying which patrons were responsible for each addition. (Essex 1777a). This had been the main objective of most antiquarian study of architectural monuments, exemplified by Charles Lyttelton's essay, "Some Remarks On The Original Foundation and Construction Of The Present Fabric Of Exeter Cathedral" (Lyttelton 1754).

Essex would have known Lyttelton, then Dean of Exeter, through his advisory role on the restoration of Ely Cathedral from 1759 (British Library, Stowe MS 743, f.41, cited in McCarthy 1987, 23). Its focus on chronology makes Essex's published work, in general, less methodologically original —and to modern construction historians— less exciting, than his manuscript material. He was providing for the needs of two different readerships and tailoring his output accordingly.

Conclusion

Essex was one of the first antiquaries to develop what we might now term, a "period eye," writing of medieval masons that "when we consider the greatness of their designs, we must allow that they had a taste well adapted to the religion and genius of the age in which they lived." (Essex 1777a) His ability to date by style was well developed when it came to Gothic architecture, but the majority of his scholarship was devoted to Romanesque architecture, for which his desire to antedate surviving structures, combined with an Enlightened and Protestant suspicion of monastic chroniclers' claims of wholesale destructions and rebuildings, led him to identify Norman fabric as Saxon if the history of the site allowed. He was nevertheless the first to identify two of what are still accepted as hallmarks of Saxon construction, one of the first to propose a partially accurate denomination of the typical monastic groundplan and —perhaps most significantly— in the vanguard of visualising buildings in their original form by the virtual removal of later elements.

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Essex and the "mathematical" bridge of Queens' College, Cambridge

Jacques Heyman

Isaac Newton died in 1727. He had nothing to do with the 15-metre span timber pedestrian bridge of Queens' College, Cambridge. Much detailed information on the bridge may be found on the College's website, and includes the refutation of many falsehoods and legends about its design and construction.

A view of the bridge is shown in fig.1; it was built in 1749. At that date there was some interest in "Chinese" styles, and that epithet was sometimes (wrongly) applied to the Queens' bridge. With greater structural insight, the bridge can be described as having tangent and radial trussing – the long straight members are "tangent" to "circular" arches, and form, with the radial members connecting the arches and handrails, two-dimensional stiffening trusses, between which runs the walkway.

The design of the bridge is attributed to William Etheridge in 1748, and he supplied the College with a 1/16 scale model (which the College still possesses). Etheridge was a master carpenter who worked under one James King from 1734, and who replaced King when he died in 1744. (For information about masters and craftsmen in the eighteenth century see Colvin 1995.) King and Etheridge were involved in the construction of a bridge for Westminster, and King's design in timber of 1737 (twelve years before the Queens' bridge) used the same system as at Queens' of tangent and radial trussing. The timber bridge was not built; instead, a masonry bridge was started in 1741, and King was involved in the design of timber centres to support the arches while they were being constructed. These centres again used the system of tangent and radial trussing.

Figure 1
The bridge looking north

Just before the Queens' commission, Etheridge designed Old Walton Bridge, which was constructed in 1748-50; it is shown in fig.2, and in Canaletto's painting of 1754 in fig.3. The bridge is on a much larger scale than that of Queens', having a central span of 130 feet (compared with 50 feet at Queens'). It decayed, and was taken down in 1783. Thus bridges of this design could be seen at the time of the Queens' bridge, and the novel system of tangent and radial trussing must be attributed to King, to be inherited by Etheridge after King's death in 1744.

Figure 2
Old Walton Bridge 1748-50

Figure 3
Canaletto's painting of Walton Bridge

Essex was aged twenty seven in 1749, and his career illustrates the change that had been proceeding for nearly a century in England; the "medieval" master builder was becoming a recognisably modern architect. The first such architect (discounting the stage designer Inigo Jones) was Christopher Wren, a professor of astronomy at Oxford; he had received no training in the building trade, but was nevertheless prepared and able to oversee the design and construction of large enterprises (Heyman 2003). The Sheldonian Theatre in Oxford of 1644 was designed by Wren, aged thirty two; his uncle Matthew Wren had, a year earlier, imposed Christopher on Pembroke College, Cambridge as the architect for the new chapel (the "Wren" chapel), which was in fact already under construction. The chapel had been designed and was being built by Edward Pearce (Grimstone 2009).

Pearce was again a medieval master who entered into design/build contracts. Such masters provided overall designs together with drawings, they employed their own labour force to carry out the work, and sometimes owned their own quarries. They were learned and well-respected – an important commission could lead to a knighthood. As was usual in securing commissions, the master would produce a model for the client, and the wooden model for Pembroke Chapel is at a scale of about 1/32. Pearce continued to work, with his men, under Wren's direction, and indeed he was content to work later as one of several building contractors on St Paul's Cathedral.

James Essex was, in 1749, a master of this sort. He was the son of James Essex, a master carpenter and joiner of Cambridge, who died in that same year, and the son took over his father's business, which was concerned with the design and construction of timber structures. (At the same time, James Essex wished to become a "modern" architect, and he made wider studies, for example under Sir James Burrough.) It was to the local timber contractors that Queens' College turned for the construction of their bridge. It is not known whether an "Etheridge" bridge was suggested by the College, or whether it was Essex who proposed that such a bridge should be built.

The new timber bridge inevitably suffered decay, and minor repairs were made during its first hundred years of existence; major repair work was carried out in 1866. In 1905 the whole bridge was taken down and replaced by the present copy, but the wood used was teak rather than the original oak.

Structural analysis

It will be seen from fig.1 that the bridge has seven bays, defined by the abutments and the six radial members. The long tangent members clearly define an arch, which has a rise of 2.5m and a span of 15m. The planks of the footway follow the shape of this arch in the three central bays, and are then straight in the two outer bays on each side, following the lines of the longest tangent members used in the construction. The planks of the footway transfer their loads to cross-beams connecting the two sides of the bridge, and so cause forces in the members of the structure.

Where they cross, all members are pinned together with bolts, and the whole construction may be categorized as a truss, with the wooden members acting mainly in tension or compression as dictated by the equations of statics. The structure is, in a technical sense, highly redundant – that is, there are many possible ways in which a given loading may be carried (cf the three-legged stool, whose leg forces may be found immediately, compared with one having four legs, where the leg forces are crucially dependent on the way the stool is supported). This redundancy, or statical indeterminacy, makes it impossible to derive a unique structural solution to the mode of action of the bridge. However, the engineer can rely on the absolute assurance of the "safe theorem" of plastic theory (Heyman 2008) – if *any* solution can be found with which the bridge is comfortable, then the bridge can certainly carry the applied loading. By "comfortable" is meant that the forces in the tangent and radial members, which must certainly obey the equations of static equilibrium, are also sufficiently low that the teak (originally oak) members are not overstressed.

Thus a first (as it turns out, satisfactory) assumption is to accept the immediate visual impression that the main effective members form the piecewise linear "circular" arch of 15m span and 2.5m rise. (The circle, the piecewise linear "circle", the parabola, and the ellipse, differ from each other by only a few millimetres over the span of this arch.) The total weight of material in the bridge may be estimated as about 6 tonnes (60 kN), and this weight is imposed on the arch by a series of more or less concentrated loads acting at the points of intersection of the radial members and the tangent members forming the arch.

As is usual in analysis of this sort, these concentrated loads can be "smeared" into a uniform loading W across the span of the bridge – the numbers resulting from the calculations (values of stresses in the members, for example) are not sensitive to this simplifying assumption. If the total uniform dead load (60 kN) is assumed to be carried *only* by the members of the arch of span l (15m) and rise d (2.5m), all other portions of the structure remaining unloaded, then the arch must be supported at each end by a vertical force $\frac{1}{2}W$ (30 kN) and a horizontal thrust $Wl/8d$, or $\frac{3}{4}W$ (45 kN). These two support forces combine to give a maximum resultant compressive force in the arch members of about $0.9W$ (54 kN).

All the main members of the truss are of cross-section 120×100 mm (5×4 in 1749 inches?), and all these members are in fact doubled. The bridge has, of course, two sides, so that the maximum compressive force of 54 kN is shared between four members, leading to a stress of (54000)/(4)(120)(100) = 1.125 N/mm². This figure is quoted much too accurately – the calculation shows that a maximum dead load stress of about 1 N/mm² may be expected. Permissible compressive stresses are 12.6 N/mm² for timber D 40 (teak) and 8.1 N/mm² for D 30 (oak) – in either case the dead load stresses are low.

However, live loading will increase these working stresses. For pedestrians on footbridges a typical specified loading is 5.0 kN/m² (five rugby forwards on each square metre); the bridge has a width of just under 2m, so that a total pedestrian load (uniformly distributed on the span of 15m) is 150 kN (or ten Rugby Union teams of 15 players each). The resultant stresses will be increased in proportion to those induced by the 60 kN dead weight of the bridge, and the maximum in the arch members has a value of about 4 N/mm², still substantially below the values permitted for both teak and oak.

These loadings, dead and live, have been symmetrically disposed on the bridge, enabling the particularly simple equilibrium solutions to be established. Unsymmetrical loading will lead to more complex response patterns of the forces in the members of the bridge. For example, five rather than ten Rugby Union teams might decide all to stand on one half only of the bridge, say between the bank and the centre. In this case portions of the tangent beams lying above their lowest arch sections will come into play.

It must be emphasized again that it is impossible to establish the "actual" behaviour of the bridge, which depends on unknowable factors such as slight looseness of joints, imperfections in the assembly of members, temperature and humidity conditions, and so on, all of which can have a marked effect on the distribution of forces in the bridge. What must be done, however, is to establish that there is a possible system of forces which can equilibrate the prescribed loading; if the analyst can determine any one such system, then this is assurance that the bridge is "comfortable". In the case of the asymmetric live loading on half the span of the bridge, portions of the members lying outside the notional arch will be stressed. It is not difficult to determine forces in the bays defined by the radial members, and braced by the "St Andrew's Cross" members, which equilibrate the loading, and which induce acceptable values of stress in the individual members. The handrails (140×160 mm as opposed to 120×100 mm for all the other members) will also play their part in this loading.

Conclusion

Palladio in his *Four Books on Architecture* (1570) discusses briefly the construction of wooden bridges (Heyman 2000). This is the first publication to illustrate triangulated or trussed frameworks, although Trajan's Column in Rome has a relief of a trussed bridge over the Danube, built by Apollodorus of Damascus about 100 AD, fig. 4. Timber trusses were in use from an early date for roof structures, but no early trussed bridges have survived.

Palladio gives no calculations for the design of his bridges. The triangulation shown in fig.5 is efficient, but the distribution of material is precisely

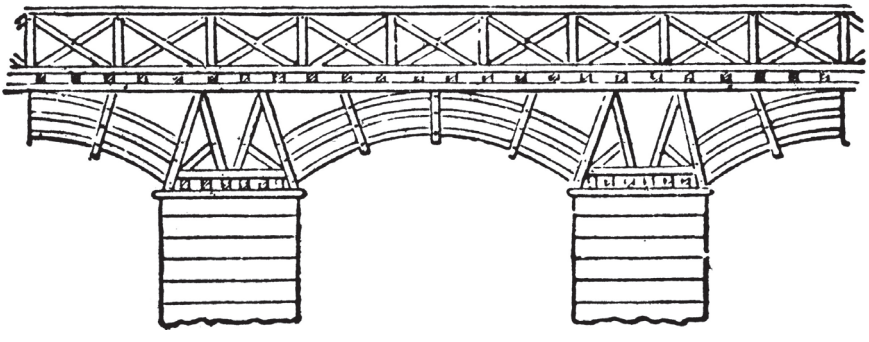

Figure 4
Detail of bridge from Trajan's Column

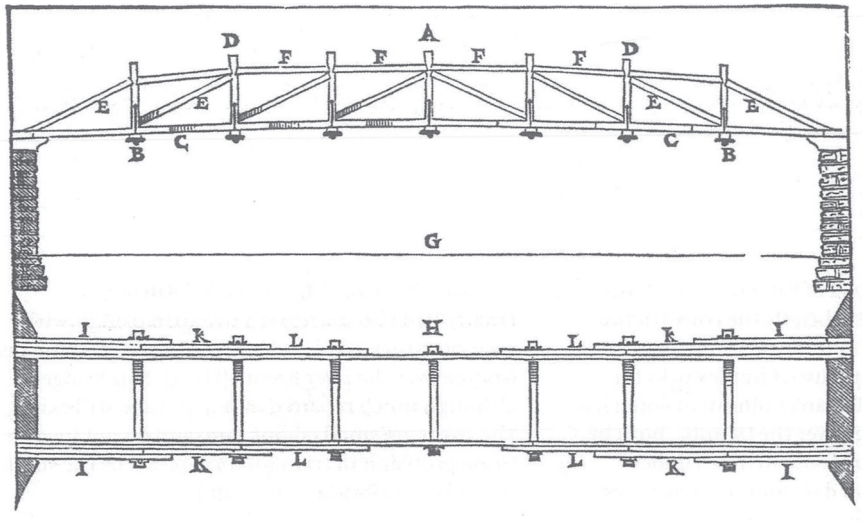

Figure 5
Palladio's design for a bridge at Cismone

wrong – the heaviest material is needed at the centre of the bridge, and should diminish towards the ends. Indeed the engineering analysis of trusses, first of timber and then of iron and steel, developed only in the nineteenth century. It is certain that Etheridge made no calculations in relation to the Queens' bridge. Similarly, at the same time (1757) Grubenmann constructed a timber bridge at Schaffhausen with two spans of over 30 m, again without calculation (fig. 6).

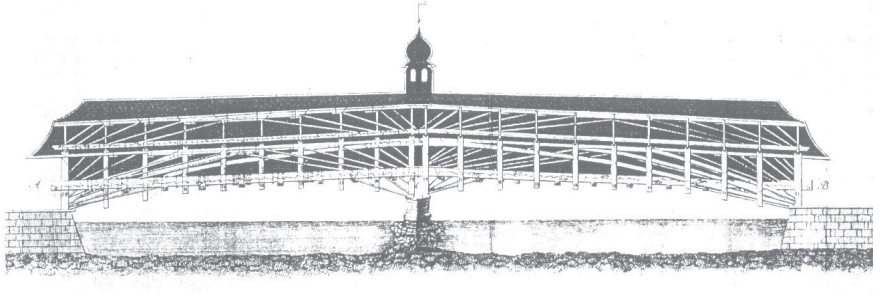

Figure 6
The bridge at Schaffhausen (1757)

To the eye of the modern structural engineer, the Queens' bridge seems curiously devised. The long raking members (the tangent members) effectively define the arch, but the portions lying above the arch serve less as primary load carriers, and more as stiffeners and stabilizers for the structure as a whole (the St Andrew's crosses). However, the overall structural action is certainly satisfactory, and the use of long members implies fewer individual elements of the bridge, with corresponding savings in construction costs.

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Essex and Strawberry Hill

Claudia Marx

The development of Horace Walpole's Strawberry Hill over the course of the second half of the 18th century involved the artistic and scholarly contributions of a number of collaborators, from Walpole's circle of friends and amateur designers comprising his "Strawberry committee" to craftsmen and professional architects (Riely 2009, 349). Noteworthy though not outstanding among the latter is James Essex, whose involvement at Strawberry Hill dates to the late 1760s and 1770s. This chapter traces Essex's contributions to the extension of the house and the design of garden structures, looking at the respective roles of Essex and Walpole and the significance of the architect's work in the context of Strawberry Hill's evolution as a house of the Georgian Gothic Revival.

By way of overview, the development of Walpole's Twickenham villa can broadly be divided into two main phases. During the early period of construction, the focus lay on remodelling and enlarging an existing tenement on the Thames-side plot that Walpole had originally leased and then purchased in 1749. A second phase, from about 1760, encompassed the major westward extension of the house, further transforming it into what Walpole frequently described as his "little gothic castle" or sometimes also with monastic references (Snodin 2009, xiv-xv, 15; Rogers 2009, 59, 63). This second phase was completed in the 1770s, at a time when James Essex was involved in some work to the house. While the earlier building period was marked by a more fanciful application and interpretation of Gothic design sources, the later phase was characterised by Walpole's growing antiquarian awareness and interest in achieving a greater degree of accuracy when deriving decorative features from historical prints or extant medie-

val buildings (Snodin 2009, 45; Harney 2013, 131; Lindfield 2016, 148). An early Essex scholar, Donald Stewart, came to argue that it was chiefly due to the architect's influence that Walpole, "after his Rococo Gothic start, turned more and more antiquarian" (Stewart 1950, 317). However, this statement does not stand up to the chronology of their professional acquaintance nor the available evidence on the nature of their relationship.

James Essex was involved in the design of four Gothic-style structures at Strawberry Hill: a pair of piers for a gate (1769), the Beauclerk Tower and Closet (1776-77), the New Offices building (also 1776-77) and a garden bridge (1778). Essex's architectural contributions to the house and garden, therefore, mainly fall into the mid- to late 1770s, a period when the transformation and expansion of Walpole's villa was drawing to a close. The previous two decades had seen the creation of the rooms of the State Apartment (Figure 1: "A, B, C, D"), where a greater degree of seriousness is noticeable in the drawing of quotations from medieval buildings and tombs than before. But this did not extend as far as to the materiality or function of medieval structures, as the elegant fan-vaulted ceiling in the Gallery (Figure 1: "D"), for instance, which was modelled on the side aisle of Henry VII's Chapel at Westminster Abbey, was carried out in plaster and papier-mâché and not in stone (Snodin 2009, 45-50; Harney 2013, 131).

In the decoration of the state rooms and the design of garden structures during the 1760s and early 1770s, Walpole chiefly collaborated with his longtime friend, the amateur architect John Chute, who had contributed to Walpole's Gothic villa since the early years of its development. In the early period, Chute had occasionally competed with the artistic talent of the draughtsman Richard Bentley, another important collaborator of Walpole, who had a more playful, fanciful style and had produced some of the most significant earlier work at Strawberry Hill before he fell out with Walpole by the early 1760s (Rogers 2009, 61-62; Calloway, Snodin and Wainwright 1980, 24).

Both during the earlier and later development stages, Walpole also relied on the skills of professional architects to realise his vision. William Robinson, for example, clerk of works at Greenwich Hospital and Secretary to the Board of Works, was involved in the practical execution of building projects at Strawberry Hill until the early 1770s, and had even contributed some early designs to the house, later diminished by Walpole as "not truly gothic" (Rogers 2009, 60; Barker 2010, 17).[1] On the other hand, for the decoration of the Round Drawing Room (Figure 1: "A") in the mid-1760s, Walpole sought the assistance of the fashionable architect Robert Adam. Yet, in this as in other architectural projects at Strawberry Hill, Walpole kept overall control over the design process. Adam, for instance, was given firm instructions as to the historical precedents to be adopted in the design of the Round Room ceiling and chimneypiece, foreshadowing how

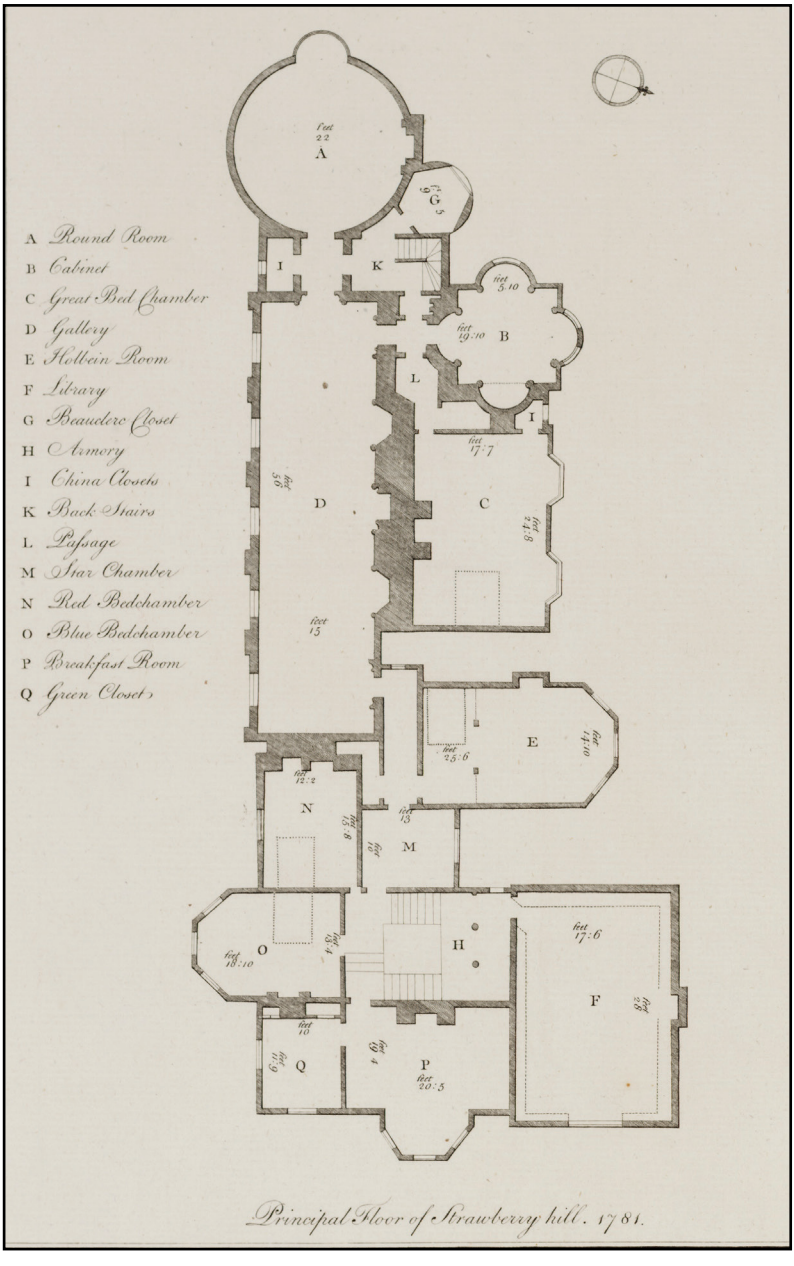

Figure 1
Plan of the first floor of Strawberry Hill, 1781. (Courtesy of The Lewis Walpole Library, Yale University)

Walpole came to approach his first project with James Essex later (Wilton-Ely 2011, 4-5; Rogers 2009, 61).

Robert Adam, who during the 1760s also produced two unexecuted designs for a garden cottage at Strawberry Hill, eventually constructed chiefly to a design by John Chute, was not engaged further by Walpole in the 1770s. Indeed, Walpole became increasingly dismissive of Adam's style, calling it "all gingerbread, filigraine [sic], and fan painting" (Lewis et al. 1967, 24: 93; Wilton-Ely 2011, 7-9). Adam's decline in favour with the owner of Strawberry Hill coincided with Walpole's growing admiration for another architect, James Wyatt, whom he came to consider "grander, and more pure" after visiting the latter's Pantheon building in London's Oxford Street in 1771 (Lewis et al. 1967, 24: 93; Wilton-Ely 2011, 8-9). Yet despite Walpole's repeated statements of approval of the architect's taste, Wyatt was not asked by him to undertake any work at Strawberry Hill until 1789, as far as we know, and then only to execute the New Offices building designed by James Essex over a decade earlier.

The story of Essex's involvement at Strawberry Hill is one dominated by Walpole's large body of correspondence. Little survives of Essex's own records that documents his work for Walpole. However, this imbalance is offset to some extent by the surviving letters of the Reverend William Cole, who was Walpole's chief point of contact with regard to Essex's commissions at Strawberry Hill. Both Walpole's and Cole's letters have been published in W. S. Lewis's comprehensive edition of *Horace Walpole's Correspondence* (1937-1983). Their written exchange over two decades on antiquarian and other matters is not only significant in documenting Walpole's collection and the development of his Gothic villa, but also helps to broaden the perspective on Essex's employment at Strawberry Hill, as we shall see.

The antiquary William Cole was one of Horace Walpole's frequent correspondents and Cambridge connections. From a non-aristocratic background, Cole had overlapped in attendance at Eton and King's College, Cambridge, with him in the late 1720s and 1730s. Following a letter from Cole in 1762, in which he commented in detail on Walpole's first two volumes of his *Anecdotes of Painting in England*, the two men developed an active correspondence on antiquarian matters, which lasted until Cole's death in 1782 (Lewis and Wallace 1937, 1: xxv-xxvi, 1-11; Walpole 1951, xix-xx; Pickles 2004). A partially absentee clergyman with livings in Buckinghamshire and Cambridgeshire, Cole industriously pursued his antiquarian and genealogical studies, sharing his knowledge with Walpole and on several occasions sending him prints, books and other items for his collection at Strawberry Hill (Pickles 2004; Lewis and Wallace 1937, 1: 184-89).

One of Cole's major interests was the study of the history and antiquities of Cambridgeshire, including the medieval period. This put him at the centre of a

network of antiquaries with local connections who concerned themselves with the Middle Ages, which included James Bentham, Richard Gough, Michael Tyson and James Essex. During their later years, Cole formed a closer friendship with Essex, who visited him during bouts of the gout and acted as executor of his will after his death (Pickles 2004; Lewis and Wallace 1937, 1: 371-73; Nichols 1831, 6: 297). From the close of the 1760s Essex features in surviving letters between Cole and Walpole, with Cole frequently taking the role of messenger between the two men. There is only one letter from Walpole to a recipient inferentially identified as James Essex in W. S. Lewis's compilation of *Horace Walpole's Correspondence*, although Essex visited Walpole and Strawberry Hill on several occasions, both professionally and for leisure, and exchanged some correspondence with him (Lewis et al. 1980, 41: 235; Lewis and Wallace 1937, 2: 15-16).[2]

Judging by these extant letters, the first point of contact between Walpole and Essex seems to have been at Ely Cathedral. In 1769 Walpole was asked by Bishop Mawson of Ely to advise him on his plan to install new painted glass in the east window of the Cathedral (Toynbee 1904, 7: 283). Walpole was an avid collector of old stained glass, chiefly 16th- and 17th-century glass that he had imported from Flanders and which he incorporated into his windows at Strawberry Hill. By the early 1760s his stock of historic glass was mostly depleted, leading him, for example, to employ the York glass craftsman William Peckitt to produce new painted glass for his Gallery windows (Peover 2004, 22-23, 26; Lewis and Wallace 1937, 1: 145). In 1768 Peckitt's name appears to have been discussed by the Bishop and Chapter of Ely as someone who could undertake the work to the Cathedral's east window (Lewis and Wallace 1937, 1: 146). In the event another glass painter, James Pearson, was commissioned by Bishop Mawson to make stained and painted glass for this never completed scheme (EDC 4/5/19). Around 1770, Pearson also undertook some work for Walpole at Strawberry Hill. However, in December that year, shortly after Bishop Mawson's death, Walpole wrote to Cole: "To say the truth I have no very sanguine expectation about the Ely window. The glass-painter, though admirable, proves a very idle worthless fellow, and has yet scarce done anything of consequence" (Lewis and Wallace 1937, 1: 206; Peover 2004, 28).[3]

Walpole visited Ely together with William Cole in July 1769[4] and, as can be inferred from their exchange immediately afterwards, may also have met James Essex during this trip (Lewis and Wallace 1937, 1: 178, 183).[5] Essex had been employed at Ely Cathedral since the mid-1750s, and at the time was working on a scheme for removing the choir from its position below the Octagon to the far east end of the church. A drawing by Essex of October 1768 (Figure 2) shows the elevation of a new altar reredos with a triple-gabled central portion, similar in its

general arrangement to the tomb of Bishop William de Luda (d. 1298), placed in front of the east wall of the Cathedral (Cocke 1984, 32-33, 51-52; Lindley 1987, 102; Cocke 1975, 14-16).[6] De Luda's monument was then, and still is, located on the south side of the presbytery at Ely. It was damaged and partially obscured by the relocation of the choir stalls during 1769-72, and was restored in conjunction with the choir re-ordering under George Gilbert Scott in the mid-19th century (Lindley 1987, 102-03, 106; Bentham 1771, 214, 284, plate XL).

In addition, Essex's drawing also shows an organ above his new altar reredos (Figure 2), where it obscures most of the centre light of the east window for which new stained and painted glass was proposed. No doubt at least partly because of this, the plan to site the organ at the east end of the church was dropped. Presumably in response to Essex's design of October, the Chapter of Ely agreed in November 1768 "That the Organ be Erected at the West End of the New Choir" and that "Mr. Essex be desir'd to draw a Gothick Sketch of the New Organ Loft" (EDC 4/5/54; Lindley 1987, 102). However, the matter was still unresolved the following July, as Horace Walpole was presented with two plans on his visit, one proposing to locate the organ at the west end of the new choir, the other to place it on one side below one of the arches of the north aisle. In this context, Walpole was evidently shown a design prepared by Essex that he deemed "very light" and "airy", perhaps the architect's unexecuted scheme for a western screen without organ, which he had drawn up in conjunction with his reredos proposal of October 1768. While Walpole favoured the plan to put the instrument on the north side, as he thought the organ on a screen at the west end of the choir would obstruct the view of the whole building, nothing came of this idea (Lewis and Wallace 1937, 1: 185, 192; Cocke 1984, 32, 51; Lindley 1987, 102). As previously, the organ was installed at the west entrance to the choir over a new screen and organ loft designed by Essex, though now in the presbytery instead of the nave. The existing 12th-century pulpitum across the nave was demolished. At the far east end, a modified version of Essex's altar reredos design of 1768 was executed (Lindley 1987, 100, 102-04; Fearn 1997, plate XXIc).

Walpole's visit to Ely proved fruitful in another respect, however, as it led to Essex's first brief for Strawberry Hill. Clearly inspired by the medieval monument to Bishop de Luda as a potential source for new Gothic work, Walpole wrote to Cole immediately after his return from Ely, sending him instructions for the design of two gate piers that he wished to put up at Strawberry Hill: "*Imprimis* then, here are the directions for Mr Essex for the piers of my gates", he stated. "Bishop Luda must not be offended at my converting his tomb into a gateway" (Lewis and Wallace 1937, 1: 178). His letter includes two very rough sketches, one showing the configuration of an existing pair of gates that he wanted to use for the project, the other his idea for the tops of the new piers based on

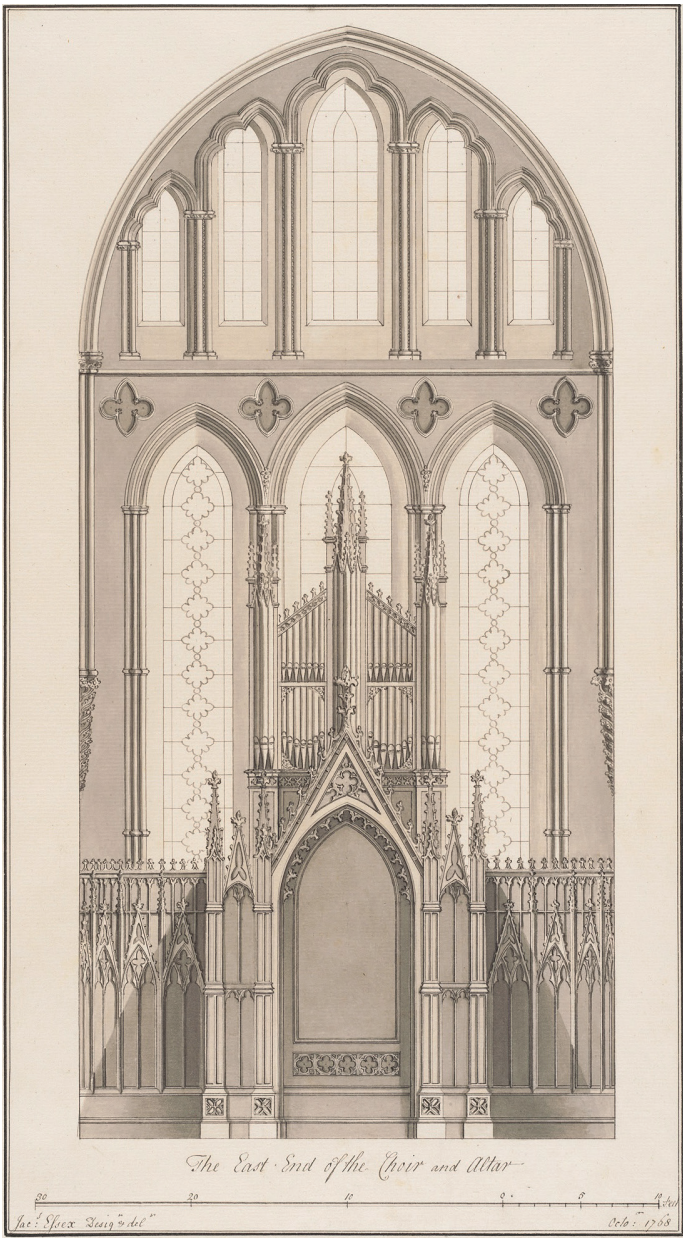

Figure 2
"The East End of the Choir and Altar" at Ely Cathedral. Design drawing by James Essex dated October 1768. (Photograph © The Fitzwilliam Museum, University of Cambridge)

the de Luda tomb (Figure 3). After providing measurements of his iron gates, he told Cole: "The piers should certainly, I think, be a little, & not much higher than the ornament over the gates, but Mr Essex will judge best of the proper proportion." He further instructed: "I would not have any bas relief or figures in the bases. The tops to be in this manner (Figure 3) – nothing over the gates themselves." However, he added, "I have drawn these piers too wide" (Lewis and Wallace 1937, 1: 179, 190).

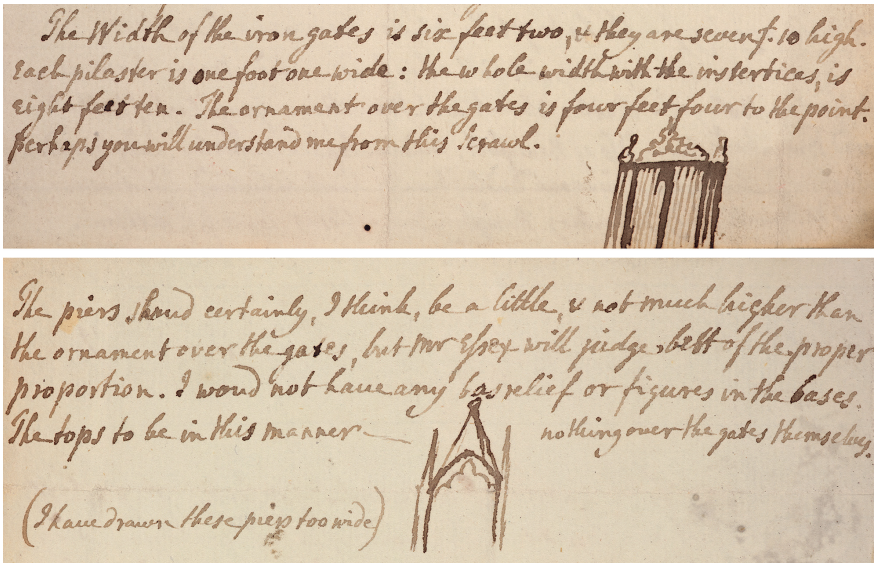

Figure 3
Extracts from a letter from Horace Walpole to William Cole with two ink sketches, 15 July 1769. (© The British Library Board, Add MS 5952, folio 69)

An engraving in *A Description of the Villa of Mr. Horace Walpole* of 1784 depicts the gates and piers as executed in the grounds at Strawberry Hill (Figure 4). Drawn up within a few weeks of the above letter to Cole, Essex's design for the piers was closely modelled on the outer bays of the de Luda tomb. Walpole was satisfied with the design, telling Cole in August 1769: This "is just what I wished" (Lewis and Wallace 1937, 1: 190).[7] The de Luda gate piers are an example of Walpole's interest in achieving a level of correctness when drawing quotations from medieval prototypes, which characterised the later development phase of Strawberry Hill. Since Essex, as the architect to Ely Cathedral, was already familiar with the de Luda monument, he was an obvious choice for this particular project. But like

Robert Adam before him, Essex was given a specific Gothic prototype to work with and concise directions, leaving him little creative leeway in the overall design (Wilton-Ely 2011, 5; Lindfield 2016, 148-49; Harney 2013, 131).

The gate piers were completed by 1771, when Walpole described them as "of artificial stone and very respectable" (Lewis et al. 1967, 23: 311). Their likely location was on the western boundary of his estate along the road to Teddington

Figure 4
View of the garden gate at Strawberry Hill, Thomas Morris, c. 1784. (Courtesy of The Lewis Walpole Library, Yale University)

and Hampton Court.[8] They were made of Coade stone, a ceramic material developed by Eleanor Coade, whose firm became the leading manufacturer of "artificial stone" sculptures and architectural ornament in the later 18th century (Kelly 1990). Following completion of the piers, a dispute arose about their cost. The issue was investigated by the architect Sir William Chambers, whom Walpole had asked to arbitrate on his behalf. Chambers' letter of June 1772 provides an interesting insight into the model-making, moulding and firing processes involved in making the piers. Their final cost was settled at £151 14s. 10d., not very far from Eleanor Coade's claim excluding profit (Lewis et al. 1980, 41: 227-29; Kelly 1990, 107-08; Toynbee 1927, 13). James Essex does not appear to have been involved in the execution, merely providing a design drawing for this small project. Significantly, he refused payment for this work, in turn sending a request for advice to Walpole via Cole concerning his intention to compile a "regular treatise on Gothic architecture" (Lewis and Wallace 1937, 1: 184, 193).

Essex made several attempts to obtain Walpole's guidance and patronage for this book project (Lewis and Wallace 1937, 1: 184, 204, 284-85). In 1769, in response to Essex's initial approach, Walpole suggested that the treatise ought to be a collaboration, with Essex, Cole, Michael Tyson and himself contributing sections in accordance with their respective areas of expertise and interest. Essex's part was to "consist of observations on the art, proportions and method of building, and the reasons observed by the Gothic architects for what they did" (Lewis and Wallace 1937, 1: 190-92). However, subsequently Walpole became unsteady in his support, citing his age, ill health, his own publication projects and the expense of the required engravings as reasons for his wavering commitment and reservations about the scheme (Lewis and Wallace 1937, 1: 205-06, 286, 310). Essex's proposed history of Gothic architecture was never published. This was much to the regret of fellow antiquaries such as Michael Tyson who by the 1770s widely acknowledged Essex as someone who understood "the technical part" of Gothic architecture (Fawcett 1888, xxxii). However, another supporter of Essex's book project, William Cole also saw limitations to his learning, telling Walpole in 1774: "Mr Essex … has left some papers here, which I read over yesterday, about freemasons, manner of building in England, and something of Gothic architecture. I can't say it satisfies me: it seems a bundle of collections from Vitruvius, etc., ill patched together." But, tempering his criticism, he added: "When [Essex] comes to treat professedly of Gothic architecture, I am in better hopes of him" (Lewis and Wallace 1937, 1: 339-40). Cole's appraisal probably refers to a draft text, or set of draft texts, relating to Essex's paper titled: "Remarks on the Antiquity and the Different Modes of Brick and Stone Buildings in England", which he read at the Society of Antiquaries in December 1774 (Lewis and Wallace 1937, 1: 340; Essex 1777).

In terms of architectural projects initiated by Walpole and carried out by Essex, the early 1770s were marked by the erection of another external structure, though not in the context of Strawberry Hill but of another country seat, Ampthill Park in Bedfordshire. In 1771 Walpole had proposed to one of his aristocratic friends, John Fitzpatrick, 2nd Earl of Upper Ossory, to install a memorial cross to Catherine of Aragon in the park of his Ampthill estate, as the Queen had resided for a time at the former castle there during her divorce from Henry VIII. Walpole wrote to Cole in June 1771, asking him to find him among his antiquarian collection "an authentic form of a cross" as a model for this project. As before with the de Luda gate piers for Strawberry Hill, Walpole's letter contains a rough ink sketch of a cross on octagonal steps accompanied by a brief explanation of his design idea for the structure (Lewis and Wallace 1937, 1: 225-26; Lewis, Wallace and Martz 1965, 32: 53). Cole, in turn, enlisted the help of James Essex, who drew up a stone cross fitting the brief. When Essex submitted his drawing to Cole, he commented: "the style [of the cross] is suited to the age of Henry VIII, but as near as possible to Mr Walpole's design" (Lewis and Wallace 1937, 1: 226). From the surviving correspondence, it is not clear whether Cole had provided any antiquarian input to the design. Not knowing the proposed site for the memorial cross, Essex did not include a scale on his drawing, but advised that the drawn proportions should be adhered to when implementing the scheme. Walpole was pleased with the design and recommended it to Lord Ossory, who duly engaged Essex in the execution. The stone cross was installed at Ampthill Park by 1774, raised on a stepped octagonal plinth based on Walpole's initial idea and with an inscription composed by him. When visiting Ampthill that year, Walpole found it too small for its parkland surroundings. However, complimenting Essex, he told Cole: "it is executed in the truest and best taste" (Lewis and Wallace 1937, 1: 236, 240-41, 296, 338).[9]

After his 1769 drawing for the garden gate scheme at Strawberry Hill, Essex was not asked to undertake any further work there for several years. In the early 1770s work was progressing and completed on the Great North Bedchamber (Figure 1: "C"), the last of the state rooms at Strawberry Hill to be finished, bringing to a close the westward expansion of the house bar the Beauclerk Tower. In the decoration of this room, Walpole collaborated again with his friend John Chute, who contributed the design for the doors, while the ceiling was taken from one at the Vyne, Chute's Hampshire country house. The chimneypiece, designed by Walpole, was modelled on the late-medieval tomb of William Dudley in Westminster Abbey, and was executed by Thomas Gayfere, master mason to the Abbey (Barker 2010, 72-73; Snodin 2009, 45, 48-50; Calloway, Snodin and Wainwright 1980, 40). Both Chute and Gayfere were also associated with another significant building project of this period, the so-called Chapel in the

Wood, which was erected in the southwest corner of the garden at Strawberry Hill and completed in 1774 (Barker 2010, 81; Calloway, Snodin and Wainwright 1980, 43; Harney 2013, 152-53). The same year Walpole's attention was brought back to Essex as a potential executing architect for Strawberry Hill through his work at Ampthill. "If ever I am richer, I shall consult [Mr Essex] about building my offices, for which I have a plan", he wrote to Cole after seeing the finished memorial cross (Lewis and Wallace 1937, 1: 338). However, nothing further happened in this regard until 1776, when Essex was involved in the erection of the last of Walpole's additions to the main house, the Beauclerk Tower, as well as the design of the New Offices building.

The Beauclerk Tower at Strawberry Hill was raised and its principal room furnished in the span of a year between 1776 and 1777. From what can be deduced from the available records, work on the tower commenced without a prior plan for its main interior space. A letter sent to William Cole at the start of June 1776 reveals Walpole's *ad hoc* approach to this project: "What is become of Mr Essex?", he enquired. "I am actually wanting assistance at this very moment about a smaller gallery that I wish to add this summer; and which if Mr Essex was here he should build directly" (Lewis and Wallace 1937, 2: 13). The "gallery" mentioned in this letter refers to a closet that Walpole intended to build for the display of seven bistre drawings made by his friend, the amateur artist Lady Diana Beauclerk, depicting scenes from his play *The Mysterious Mother*. This double-incest tragedy in verse had been printed at Strawberry Hill in 1768 but was not widely available until 1791 (Lewis et al. 1980, 41: 322; Toynbee 1923, 13; Uden 2018, 49). Clearly conscious of the disturbing sexual subject matter of his play, Walpole sought to "have a sanctuary for [Lady Di's drawings], not to be shown to all the profane that come to see the house" (Lewis, Wallace and Martz 1965, 32: 295). Accordingly, the so-called Beauclerk Closet (Figure 1: "G") was installed on the first floor of a new tower of the same denomination, tucked between the existing Round Tower and the Back Stairs ("K").

The idea for a second tower at Strawberry Hill had already been conceived in the late 1750s. A design drawing by John Chute of *c.* 1758-59 (Figure 5) shows a smaller circular tower containing a spiral staircase attached to the then proposed Round Tower, although not in the location in which the Beauclerk Tower was eventually built and with a different function and access to it (Rogers 2009, 62, 69). Chute, whom Walpole came to regard as his "oracle in taste, the standard to whom I submitted my trifles", died in May 1776. Writing to Horace Mann the day after his death, Walpole lamented: "I shall miss him. My first thought will always be, *I will go talk to Mr Chute on this* – the second, *alas! I cannot*" (Lewis et al. 1967, 24: 209-10). The previous year, William Robinson, who had dealt with the practical side of Walpole's projects until the early 1770s, had also died, leaving

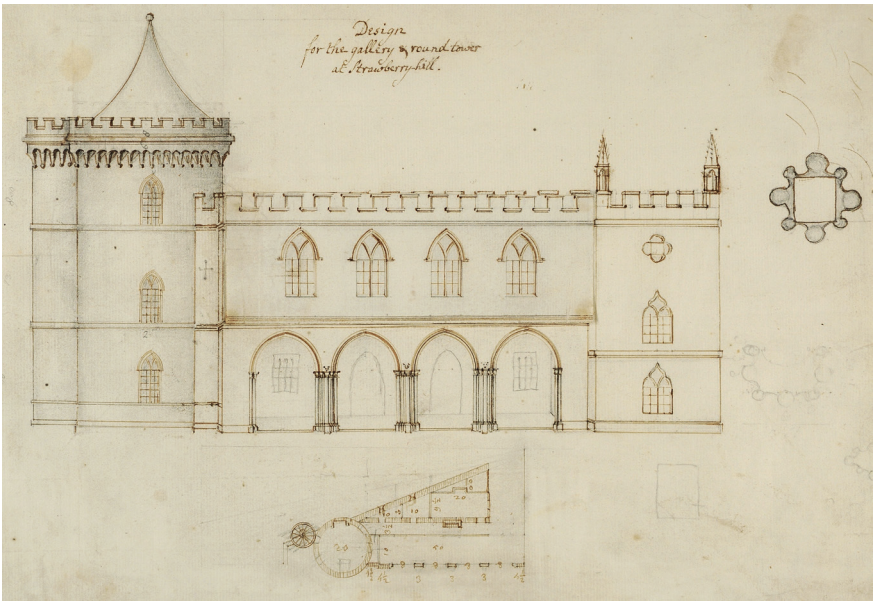

Figure 5
"Design for the gallery & round tower at Strawberry-hill", in "Slight Sketches of Architecture by John Chute Esq., of the Vine in Hampshire", c. 1758-59. (Courtesy of The Lewis Walpole Library, Yale University)

Walpole both short of an experienced executing architect and a valued designer in the Gothic style by the summer of 1776 (Rogers 2009, 60; Mackley 2004).

From June that year until the following autumn, James Essex was employed in both roles in the Beauclerk Tower project. Following Walpole's initial enquiry, Essex went to Strawberry Hill for a few days in late June 1776 to work on a scheme for the Beauclerk Closet (Lewis and Wallace 1937, 2: 15; Lewis, Wallace and Martz 1965, 32: 294; Lewis et al. 1974, 39: 275). According to Cole, he returned a month later for a second visit to "set the workmen about the new [hexagon] room", indicating that the design of the closet was developed as work on the tower progressed as well as denoting Essex's involvement in the execution of the project (Lewis and Wallace 1937, 2: 16-17). Moreover, Walpole's attendance during the architect's site visits and his comments relating to certain aspects of the tower's external appearance suggest that he, too, played a part in the design process, as had been his practice in previous projects (Lewis and Wallace 1937, 2: 18). Built in brickwork, the tower was raised by early September 1776, when Walpole wrote to Cole: "tell [Mr Essex] that the tower is covered in". He went on: "I have carried this little tower higher than the round one, and it has an ex-

ceedingly pretty effect, breaking the long line of the house picturesquely, and looking very ancient" (Lewis and Wallace 1937, 2: 24). Its most important room, the Beauclerk Closet on the first floor was completed by the following July, with Essex checking the workmen's bills for the tower in October 1777 (Lewis, Cronin Jr and Bennett 1955, 28: 318; Lewis and Wallace 1937, 2: 58, 66).

In his 1784 *Description* Walpole acknowledged Essex as the designer of the Beauclerk Closet, stating: It is "a hexagon, … designed by Mr. Essex, architect, of Cambridge, who drew the cieling [sic], door, window, and surbase. In the window is a lion and two fleurs de lys, royally crowned, ancient, but repaired and ornamented by Price … The closet is hung with Indian blue damask, and was built on purpose to receive seven incomparable drawings of lady Diana Beauclerc" (Barker 2010, 78). William Price the younger was another glass painter that Walpole had employed at Strawberry Hill. The historic glass mentioned must have been repaired and decorated by him many years before it was incorporated into the Beauclerk Closet window, as Price had retired in 1761 and died four years later (Archer 2004). Notably, Walpole does not provide any historical design sources for the decorative elements of the closet in his 1784 catalogue of Strawberry Hill, suggesting that he had completely relied on Essex to provide convincing Gothic details for this small hexagon-shaped room.

By contrast, we can find references to distinct architectural precursors concerning the exterior of the Beauclerk Tower in Walpole's personal correspondence. Writing to Lady Ossory in October 1776, before the interior was finished, he stated: "[Mr Essex] has built me a tower so exactly of the fourteenth century … It is one of those tall thin Flemish towers that are crowned with a roof like an extinguisher, and puts one in mind of that at Thornbury, called *Buckingham's Plotting Closet*" (Lewis, Wallace and Martz 1965, 32: 322). It is worth analysing this statement further, as it contains some clues as to the respective contributions of Essex and Walpole to the external configuration and appearance of the Beauclerk Tower.

A drawing by John Buckler of 1831 depicts the west view of Strawberry Hill before the 19th-century alterations to the house by Lady Frances Waldegrave (Figure 6). Like the proposed elevation drawn by Chute in the late 1750s (Figure 5), Buckler's view shows a close compositional relationship between the Round Tower (in the foreground) and the Beauclerk Tower, the latter referring to the former in general outline, mode of construction and its battlemented top. Therefore, Walpole's stated authorship of Essex must mainly relate to the provision of 14th-century architectural details, specifically the different tracery shapes used by him in the design of the three-light window and other decorative elements of the Beauclerk Closet.[10] Moreover, in contrast to Chute's drawing, where a concave conical roof is shown on the Round Tower, the Beauclerk Tower was covered with a cone-shaped roof. Thus, considering that the general idea for this kind of termination already ex-

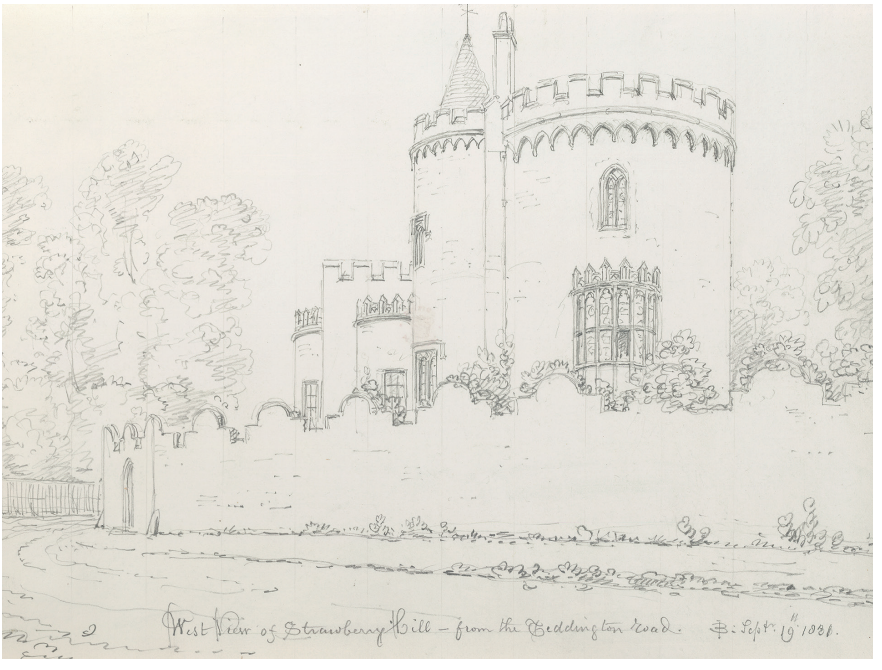

Figure 6
John Buckler, "West View of Strawberry Hill – from the Teddington Road", 19 September 1831. (© The British Library Board, Add MS 36371, folio 11)

isted, the broad-brush attribution of the Beauclerk Tower to Essex in combination with Walpole's reference to "tall thin Flemish towers" seems curious. However, in the absence of any further explanation by Walpole or other substantial evidence on this point, the reason for this must remain in the realm of speculation.[11]

Arguably, a closer visual precedent for the outline of the two towers at Strawberry Hill are the polygonal southwest corner towers of differing heights at Thornbury Castle. The idea to carry the Beauclerk Tower slightly higher than the Round Tower had certainly been Walpole's, as he had stated in his September 1776 letter to William Cole. Walpole had visited the ruined castle in 1774, writing to Cole afterwards: "I went to Thornbury, of which the ruins are half ruined. It would have been glorious, if finished" (Lewis and Wallace 1937, 1: 344). Edward Stafford, 3rd Duke of Buckingham, who was executed on the charge of treason against Henry VIII in 1521, had begun this castle in the early 16th century (Davies 2008). Therefore, Walpole's reference to "Buckingham's Plotting Closet" links the architecture of the Beauclerk Tower through imagination and association, as Marion Harney argues, to events in English history (Harney 2013, 155).

Like other parts of Strawberry Hill, the Beauclerk Tower exhibits an eclectic mix of historical quotations and associations, both in terms of its architecture and the collection of furniture, pictures and other objects it came to house in its first-floor closet (Barker 2010, 78-80). The result was a tower that provided, through Walpole's imagination and narrative, multilayered associations with the past, from 14th-century architectural details to the allusion to 16th-century historical events. Internally, the Beauclerk Closet contributed to this through its assembly of drawings and objects and the decoration of the room.[12] Furthermore, the addition of the Beauclerk Tower completed the silhouette of Strawberry Hill in a manner reflecting the 18th-century concept of picturesqueness. James Essex was the architect tasked with some of the practical aspects of building this tower as well as designing in a plausible Gothic language within the constricted space of the Beauclerk Closet.

At the same time as the erection of the Beauclerk Tower, Essex was also employed in the design of the New Offices building at Strawberry Hill, being paid by Walpole for both jobs £31 10s. 0d. in 1777 (Toynbee 1927, 16). Projected as a free-standing building a short distance to the southwest of the main house and at a right angle to it, Walpole had a clear concept for his Offices prior to Essex's involvement, telling Cole in June 1776: "I am … thinking of building my offices in a collegiate style, for which I have a good design and wish to consult [Mr Essex]" (Lewis and Wallace 1937, 2: 13). While the author of this earlier "design" is not known and it does not survive, Walpole's usual practice of working suggests that it had been conceived in conjunction with one of his collaborators. What this does tell us is that Essex was again working within certain fixed parameters, being given some kind of plan and the specification of a "collegiate style" building at the outset. A plate engraved for Walpole's 1784 *Description*, which identifies Essex as designer, shows the east elevation of the proposed Offices (Figure 7). Stylistically more restrained than other parts of Strawberry Hill, the drawing shows a symmetrically arranged two-storey façade with alternating two-light and three-light pointed windows. This is crowned with a battlement flanked by small pinnacles (Lewis 1934, 82).

Although intended for execution under the supervision of James Essex, the construction of the New Offices was not undertaken until 1790, about six years after the architect's death. In a letter to Cole in 1778, Walpole cited financial considerations for the deferment, writing: "I should be glad to employ Mr Essex on my offices, but the impending war with France deters me. It is not a season for expense!" (Lewis and Wallace 1937, 2: 75). Then evidently more optimistic about the economic impact of the Anglo-French War (1778-83), he told Cole a year later: "I do intend under Mr Essex's inspection to begin my offices next spring – It is late in my day, I confess, to return to brick and mortar, but I shall be glad to perfect my plan, or the next possessor will marry my castle to a Doric sta-

Figure 7
Proposed elevation of the New Offices at Strawberry Hill, c. 1784. Design by James Essex, engraving by Inigo Barlow. (Courtesy of The Lewis Walpole Library, Yale University)

ble" (Lewis and Wallace 1937, 2: 150). Walpole's remark indicates that the purpose of this proposed building went beyond the mere accommodation of ancillary spaces and functions. Both in terms of its architecture and through its siting Walpole clearly attempted to preserve his Gothic vision in its entirety for posterity without the possibility for later dilution, notwithstanding his repeated comments about the transience of his Strawberry Hill.[13]

Nevertheless, it took another decade until the New Offices were erected. This appears to have happened under the direction of James Wyatt, whom Walpole approached in 1789 for the execution of this project (Lewis et al. 1980, 42: 261).[14] At the time Wyatt was completing work at Lee Priory, Kent, whose Gothic transformation had been influenced by Strawberry Hill and which Walpole came to admire as "the quintessence of Gothic taste" (Lewis, Smith and Bennett 1961, 31: 342; Lindfield 2016, 43, 144, 159, 161). Monetary concerns still seem to have occupied Walpole's mind during the construction of his Offices building, telling his friend Mary Berry in July 1790: "my offices advance, and I have got in most of my hay, and such a quantity, that I believe … it will pay for half a yard of my building" (Lewis et al. 1944, 11: 74). According to a watercolour by J. C. Barrow of 1791, which shows the east view of this building after completion, only minor changes were made to Essex's arrangement of this elevation, comprising the omission of the pinnacles to the battlemented parapet and the inclusion of glazing bars in imitation of intersecting tracery to the windows (lwlpr16483). Scholars have argued that the New Offices lacked the "amateur exuberance" of earlier work at Strawberry Hill, instead reflecting the professionalism of Essex and Wyatt (Lewis 1934, 82;

Doyle 1972, 22). While this certainly played a part, Walpole's original prospect of a collegiate-style building and its ancillary function no doubt also had an impact on its external appearance with its more measured display of Gothic-style features. Financial considerations may also have been a contributing factor.

In the mid-19th century Walpole's New Offices were eventually "married" to the main house through the insertion of a large Victorian Gothic extension under the then owner, Lady Frances Waldegrave, who had inherited the property from her second husband in 1846. A renowned hostess, she had the Offices converted into guest bedrooms, with her new addition housing rooms for the entertainment of political and aristocratic guests. In this connection the Round and Beauclerk Towers were also raised by one storey to counterbalance the height and massing of the new Victorian building block. Further alterations included changes to some of the architectural details of the two towers, such as the omission of the battlement to the Beauclerk Tower and the external refacing of their walls and other parts of Walpole's villa with Roman cement (Chalcraft and Viscardi 2007, 134-36).

As far as we know from the surviving records, Essex's final contribution to Strawberry Hill was another garden structure. In 1778 he submitted a design drawing of a bridge to Walpole, which like the earlier Offices scheme was executed posthumously (Lewis and Wallace 1937, 2: 79). A plan and elevation attributed to Essex and probably dating from 1778 show the face of a bridge (Figure 8). With is prominent pointed arch and decorative Gothic detailing it references medieval features more abundantly and picturesquely than the stylistically more restrained Offices building. It is not known whether Walpole had provided any input to this design, but considering its architectural language and when compared to Essex's earlier and larger Trinity College Bridge in Cambridge this seems not unlikely. Essex's bridge for Strawberry Hill was not built until 1792 (Lewis and Wallace 1937, 2: 79; Toynbee 1927, 19). From a note in Walpole's hand on the back of Essex's drawing we know that it spanned "the rivulet at Twickenham which runs by Mr Walpole's flower-garden and crosses the road between that and Mr Briscoe's garden" (Lewis and Wallace 1937, 2: 79; lwlpr16008).[15] It does not exist anymore.

In conclusion, the picture that emerges of Essex's architectural contributions to Strawberry Hill is one that cannot be dissociated from its owner, who either supplied firm instructions and a design idea or the general framework and design objectives for Essex's work. In turn, Essex provided the skills and experience of a practical architect, and supplied Gothic details for Walpole's 18th-century architectural vision. While Essex's work at Strawberry Hill does not stand out among the contributions of other collaborators, he is noteworthy as combining the roles of executing architect and designer in the Beauclerk Tower project at a time when Walpole was in need of both skill sets. Although Walpole did not bestow

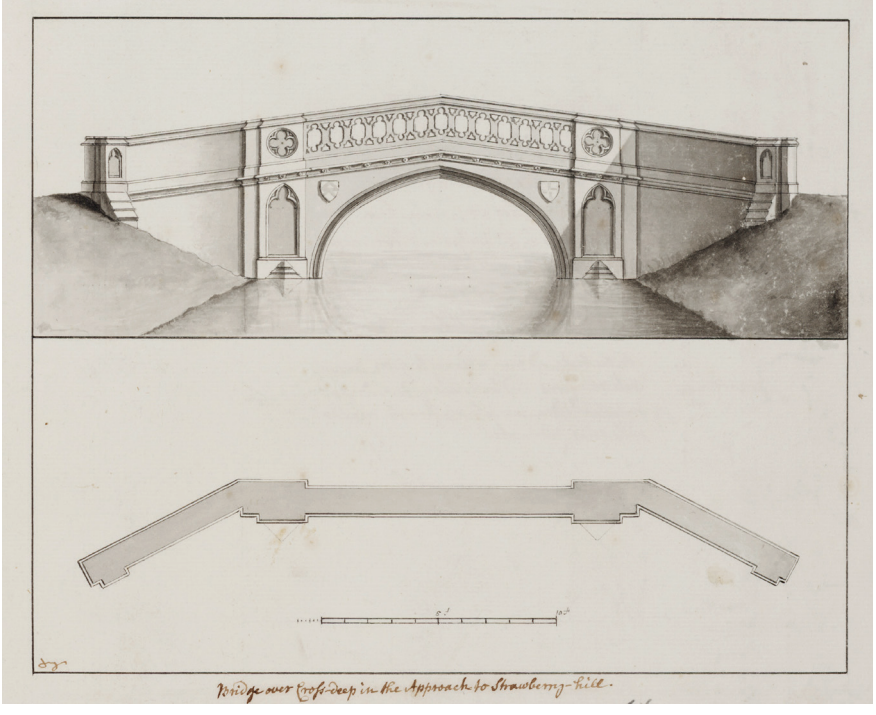

Figure 8
"Bridge over Cross-deep in the Approach to Strawberry-hill". Design by James Essex. (Courtesy of The Lewis Walpole Library, Yale University)

on him the same level of praise that he held for more eminent architects, notably James Wyatt, it is clear that he respected Essex, as he complimented his taste and expertise on more than one occasion (Lewis and Wallace 1937, 2: 314).

Given that Essex was known by contemporaries as someone who was interested in the technical aspects of Gothic architecture and sought to understand its methods of construction, his involvement at Strawberry Hill, where Gothic had primarily been revived through decoration, may not seem immediately obvious. However, as a professional architect, working in both the Classical and Gothic languages, Essex was clearly able to design and execute schemes in line with his client's wishes. Deference to Walpole as a patron and socially superior may have contributed to this, but there also seems to have been an honest admiration for Walpole's Gothic vision. In 1771, after the architect had paid a visit to Strawberry Hill together with Michael Tyson, William Cole remarked to Walpole: "[Mr Essex] is quite in raptures with your place" (Lewis and Wallace 1937, 1: 222).

Notes

1. William Robinson is last mentioned in Walpole's *Strawberry Hill Accounts* in 1773, when he was paid £200 0s. 0d. "on finishing my House" (Toynbee 1927, 14).
2. On his visits to Walpole's house in Arlington Street, London, and to Strawberry Hill, Essex, too, delivered letters from Cole to Walpole and *vice versa*.
3. Pearson only completed a small number of pieces, notably a figure of St Peter, now preserved in the north nave gallery at Ely Cathedral (Cocke 2003, 221).
4. This seems to have been Walpole's first visit to Ely Cathedral, for in 1767 he had told Cole: "Ely I have never seen." Although he suggested visiting Cole, Ely and Cambridge at that point, this does not appear to have happened until 1769 (Toynbee 1904, 152).
5. This is the first time that Essex's name is mentioned in the surviving letters in W. S. Lewis's edition of *Horace Walpole's Correspondence with the Rev. William Cole.* That Walpole may have met James Essex during his Ely visit can be deduced from the fact that he is sending him instructions and compliments immediately after his return to Strawberry Hill via this letter to Cole dated 15 July 1769.
6. This is one of a group of five drawings dated 1768 at the Fitzwilliam Museum, showing Essex's proposals for the choir at Ely.
7. An engraving of the de Luda tomb, paid for by William Cole, was published in Bentham, *The History and Antiquities of the Conventual and Cathedral Church of Ely* (Bentham 1771, plate XVII).
8. A drawing by John Carter titled "Slight sketch of the GROUND-PLOT of Strawberry-hill" of *c.* 1790 indicates Gothic gates in two locations. However, the location "F" on the western boundary described as "Iron-gate w.th gothic Piers" seems to be the most likely site of the de Luda gate piers (lwlpr15368).
9. The cross was damaged in a storm at New Year 1779, and subsequently re-erected (Lewis, Wallace and Martz 1965, 33: 81).
10. The heads of the existing two-light window to the Upper Closet on the second floor of the Beauclerk Tower are of an earlier lancet shape, the window containing plate tracery. It is not clear whether this window was designed by Essex.
11. In August 1773 Essex had made a tour through Flanders together with his daughter and his antiquary friend Michael Tyson, visiting "Popish Churches". While this is complete speculation, the chronological proximity to the Beauclerk Tower project might mean that Essex contributed or recalled the mental image of medieval Flemish architecture to Walpole's thinking, if not the actual design concept for the outline of the tower (Fawcett 1888, v, 1-71).
12. Kevin Rogers has argued that Walpole achieved the suggestion of "an elaborate fictive history" at Strawberry Hill (Rogers 2009, 72).
13. For instance, in his "Preface" to his 1784 *Description* Walpole states: "it would be strange fascination … to expect that a paper Fabric and an assemblage of curious Trifles, made by an insignificant Man, should last" (Barker 2010, i).
14. A response from Wyatt to Walpole's letter does not survive. A handwritten note on a mounting page of a watercolour of the finished Offices building reads: "The new Offices at Strawberry Hill, designed by James Essex of Cambridge, & built in 1790 drawn by J. C. Barrow 1791" (lwlpr16483). Therefore, it is not completely clear whether James Wyatt was actually involved in the execution of the building. His name is not mentioned in

connection with payments for building the New Offices in Walpole's *Strawberry Hill Accounts* (Toynbee 1927, 18).

15. And see Yale University Library, Digital Collections: https://findit.library.yale.edu/catalog/digcoll:4046805 (consulted on 11 September 2023).

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The Lewis Walpole Library, Yale University

Lwlpr15368: 'Slight sketch of the GROUND-PLOT of Strawberry-hill'. Drawing by John Carter of *c.* 1790.
Lwlpr16008: James Essex, Bridge over Cross-Deep in the Approach to Strawberry-Hill, 1778.
Lwlpr16483: View of the Offices at Strawberry Hill by Joseph Charles Barrow, 1791.

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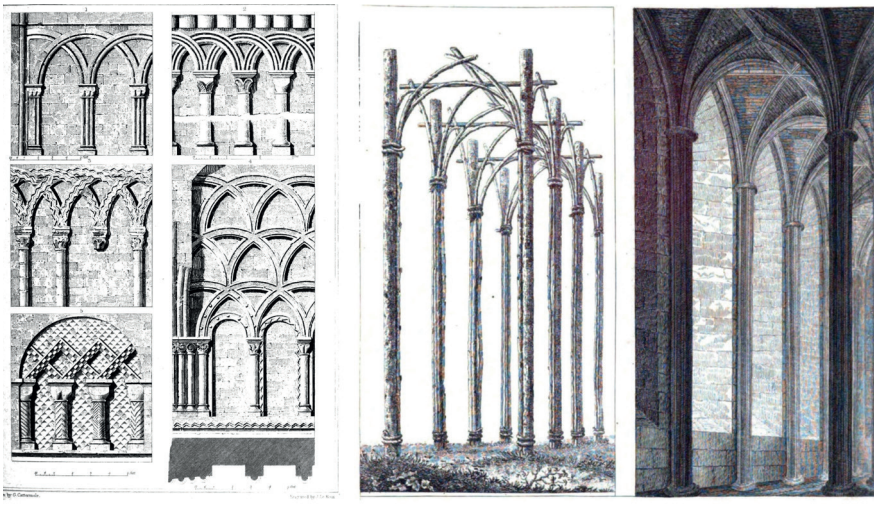
James Essex on Gothic Vaulting

Santiago Huerta

Gothic architecture was despised from the Renaissance until the 18th century. It was considered barbaric and deformed. This appreciation changed in the course of the 18th century and by the mid-century some educated gentlemen began to use Gothic motifs in their mansions. At the same time some antiquarians, architects and amateurs began to speculate about Gothic architecture. One of the central themes was its origin and it was commonly agreed that this origin was linked to the appearance of the pointed arch.

Several theories circulated and three of them were most often cited. (Pevsner 1972, 4–5) The first of these was "historical", the so-called "Saracen theory" proposed first by Christopher Wren and John Evelyn ca. 1700. (Jerrold 1977, 23) According to this theory, the Crusaders brought the pointed arch from the Arab countries of the East, which eventually gave rise to the cross vault. (Wren 1750, 297) The scond theory is "purely formal"; it was assumed that the idea of the pointed arch came from the decoration of interlaced arches that appeared decorating the walls of some Romanesque buildings, Figure 1(a); the idea circulated in the mid-18th but was first published by Bentham (1771, 37). Finally, the third theory was "romantic": the pointed arch and the Gothic came from a desire to imitate the avenues of trees which covered by the branches of the trees that intertwine in the air, imitate a nave covered by ribbed vaults. In England this hypothesis was formulated as early as 1724 by William Stukeley (1687–1765) in his *Itinerarium curiosum*, but it was James Hall (1761–1832) who, at the end of the 18th century, revived it and disseminated this fantastic but suggestive idea, even going so far as to build a "cathedral" of wicker and wood to demonstrate its feasibility (Hall 1798, 1813), Figure 1 (b).



(a) (b)

Figure 1
(a) Interlacing arches (Britton 1826). (b) Tree-theory for the origin of Gothic cross vaults (Hall 1798).

There were other bizarre theories: that Gothic naves were inspired by the keel of Noah's Ark (Clark 1964, 61) or, after Thomas Kerrich (1748–1828) (Kerrich 1812, 1821) by an old Christian symbol, the *vesica piscis*.

It is against this background of theories, opinions and speculations, that we must weigh the contribution of James Essex. The purpose of this article is to show the originality and importance of James Essex's theories on Gothic arches and vaults, and their influence in the first half of the 19th century. To put James Essex's work in context, we will briefly describe the few studies on Gothic vaulting in the 17th and 18th centuries contained in architectural and building manuals.

Gothic arches and vaults in the architectural and building manuals prior to 1750

Contrary to classic architecture, there was no original Gothic manual: there was no Vitruvius of the Middle Ages. The only document which has survived from the time of classic Gothic is the Album of Villard de Honnecourt dated ca. 1235; after Frankl (1960, 37) "Villard may be considered for Gothic as similar Vitruvius for the classical period". But Villard was published in the mid-19th. (Other late-Gothic manuals were discovered later this century.) The only information about Gothic building survived in some Renaissance and Baroque architectural treatises.

Philibert de l'Orme (1514–1570) is of particular importance. In his *Premier Tome de l'Architecture* of 1567, he described in detail the construction of a star-shaped Gothic vault, naming the elements and showing the generation of the ribs and the springing points (the tas-de-charge), Figure 2 (a). In Figure 2 (b), he was probably copying a Gothic tracing. De l'Orme's text was merely descriptive; he did not comment on the reasons for the use of pointed arches for the ribs. This example by Philibert de l'Orme, possibly taken from earlier treatises on stone-cutting, appeared in numerous later treatises in France, notably in Derand's *L'architecture des voûtes*, 1643, and in Frézier's *La théorie et la pratique de la coupe de pierres*, 1737. The main point of this illustration is that all the arches or ribs are segments of circles and are obtained from the plan of the vault.

In a previous book, *Nouvelles inventions pour bien bastir*, 1561, De l'Orme described also the generation of the groins in groin vaults formed by the intersection of two semicircular barrel vaults. The method consisted of projecting the semicircular arches on the diagonal plane of the groin. The result is an ellipse, a curve difficult to draw then, which was obtained by a series of vertical segments or ordinates, Figure 2 (c).

According to Summerson, *Architecture in Britain, 1530 to 1830*, French treatises circulated in England during the 17th and 18th centuries. As we shall see James Essex explicitly quotes Philibert de l'Orme's, and uses his nomenclature for the ribs of Gothic vaults; after Pevsner (1972, 7) he quoted also Frézier.

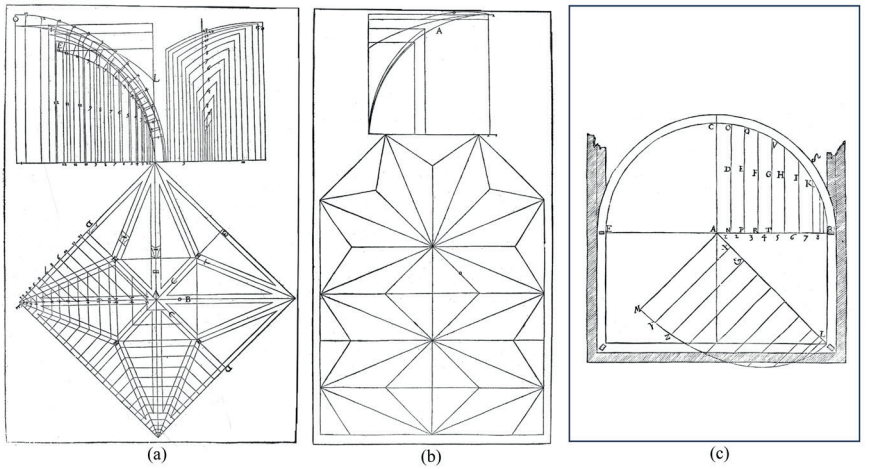


Figure 2
(a) Tracing of the ribs in a Gothic cross vault; (b) Tracing of a nave with Gothic cross vaults (De l'Orme 1567); (c) Tracing the groin in a square groin vault. (De l'Orme 1561).

In England in the 17th century, the attitude towards Gothic was extraordinarily negative. One example is Henry Wotton (1568–1639), who in his *Elements of Architecture* of 1624 criticised pointed arches, noting "the natural imbecility of the sharp angle itself " and remarked that "their very uncomeliness ought to be exiled… and left to their inventors among other relics of that barbarous age." (Wotton 1624, 51)

Christopher Wren (1632–1723) did not like Gothic either, although he had a deep understanding of Gothic structures gained from his work of inspection on the old St Paul's and also from his work on Salisbury Cathedral in 1668 and on Westminster Abbey in 1713. (Soo 1998) But, as Summerson says, this approach of Wren's was "objective and analytical," and he had no problem in choosing Gothic when he felt it appropriate —as in his Tom Tower built in Oxford between 1681 and 1682 (Summerson 1983, 256), and despite his caution against the Gothic, Wren praises the advantages of the pointed arch ". . . which could rise with little centering, required lighter key-stones, and less butment." (Wren 1750, 307) However, Wren did not use cross vaults in the nave of Saint Paul but sail vaults (a semi-sphere cut by four vertical plans); he used flying buttresses but hid them behind screen walls.

In the English treatises of the first half of the 18th century, there is already an interest in pointed arches and groin vaults. William Halfpenny in his *Art of Sound Building* of 1725 —a book that was widely distributed and influenced many contemporary architectural manuals— gives a collection of prescriptions on the design of pointed arches and groin vaults. For pointed arches he described, step-by-step, several methods. In particular he seems to be fascinated by tracing arches of any kind (including pointed arches) by a series of intersecting lines which produced parabolic segments (though he did not mention the parabola). This method was undoubtedly not medieval and probably is a joiner's method to be used at an small scale or on the drawing board. For tracing the groins Halfpenny explains only De l'Orme's method of projection, which he applies not only to groin vaults but also to lunettes, Figure 3. The same methods appear in many mid-eighteenth century architectural and contruction handbooks and can be found in the mid-nineteenth century. (Huerta 2016) These kind of joiner's methods were probably employed when replicating small-scale "lath and plaster" imitations of Gothic vaults during the Gothic Revival, when villas were built in the second half of the 18th century, notably in Strawberry Hill by Horace Walpole (see the chapter by Claudia Marx in this book).

As for the actual construction of masonry groin vaults in Britain in the 18th Century the evidence in the handbooks is very scarce. Maybe surprisingly Halfpenny discussed the building of such a vault in his *Art of Sound Building*. There is a drawing of the corresponding scaffold which is perhaps one of the first

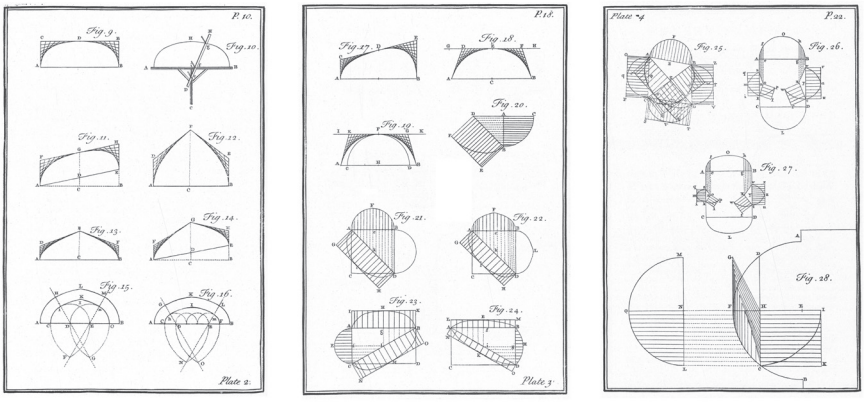


Figure 3
Tracing of arches and groin vaults (Halfpenny 1725).

illustrations on this topic in Britain (cf. Holzer 2021, for German, French and Italian sources on arch and vault centering). The accompanying text however concentrate on the cutting of the groin stones and did not mention the geometrical problem of forming the groin, Figure 4.

The only constructive description which I have found is in Francis Price's *The British carpenter*, 1735, where he explains the way to build a groin vault of square plan. Price explains first the practical method, Figure 5 (a): "I think it proper to shew the Nature of Centering of Vaults" (Price 1735, 35). In A is the

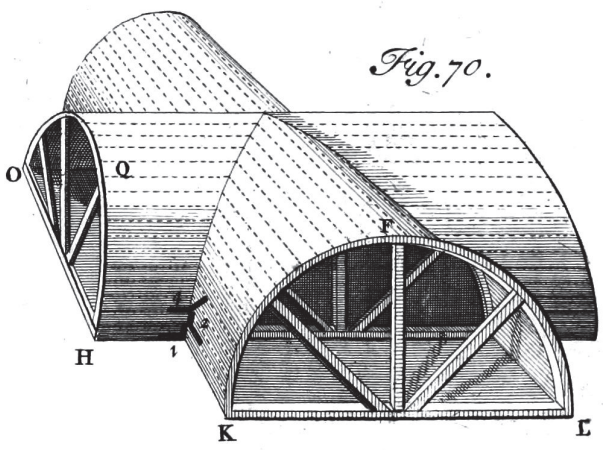


Figure 4
Scaffold for building a groin vault (Halfpenny 1725).

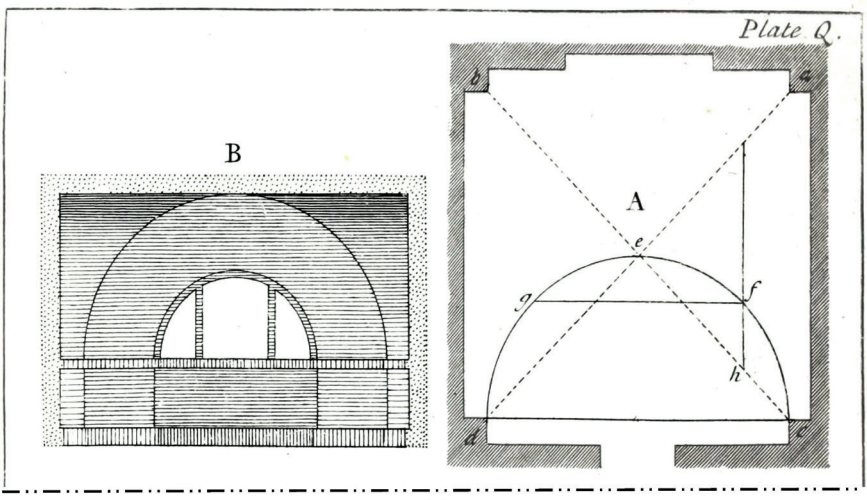
plan and in B the the section, where the form of the perimeter arches is shown. In one of the sides, for example *d*, *e*, *c*, begin centering the whole space with a "Common-Vaults", that is a barrel vault, and "Board it", complete the formwork on top of the centers. Then, Price explains how to obtain the small centers which put on the formwork would produce the cross barrel (Fig. 5 (a). The small centers *gef* in Figure 5 (a) are all segments of circle. To set them it is necessary first to draw the groins on top of the formwork. It is convenient to quote Price's whole explanation in full:

> To make your Groin streight on its Base, at some little Height over the Centers, strain a Line from *b*, to *c*, or *d*, to *a*; from which drop Perpendiculars on your Boarding, first fix'd at as many Places as you pleafe, there drive in Nails, and bend a streight Rod 'till it touch them all; and then with a Pencil, or Chalk, describe the Curve so form'd, to which bring the Boards to be nailed on these little Centers, and their Joints will form a streight Groin. (Price 1735, 35)

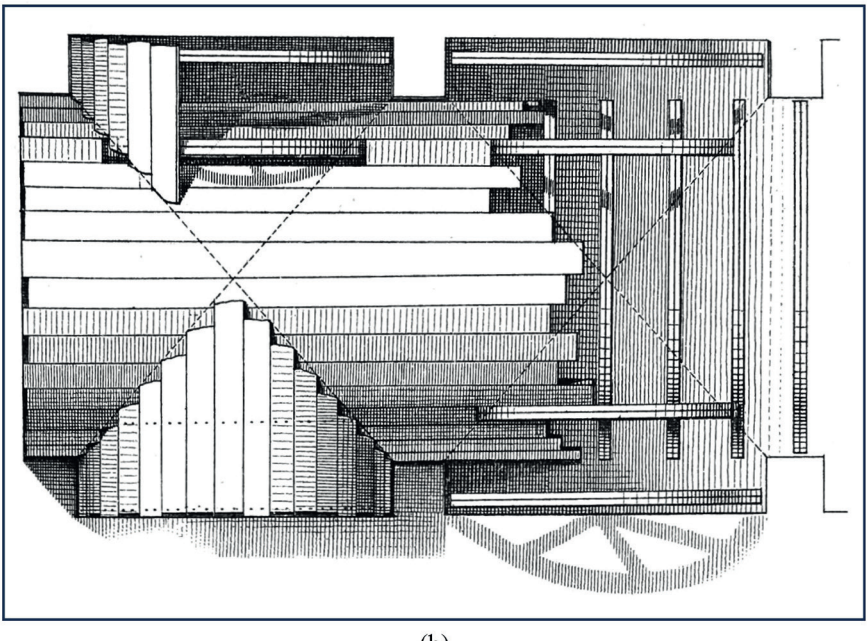
His method then continues. From the corners of the vault, a little higher than the boarded formwork of the barrel vault create tense cords. From them drop perpendiculars (with small plumb lines probably) until they touch the boards. Fix nails in these places and with a flexible rod passing through all the points trace with chalk the form of the groin lines on top of the formwork. Then it is easy to set the small centers previously prepared. Mohrmann in his additions to the 3rd edition of Ungewitter's Handbook of Gothic Construction (Ungewitter 1890, I, 9), Figure 5 (b), suggests that this was the method employed already by Roman builders and that the technique was used also by early Romanesque medieval builders (quoting observations by Schäfer (1885)); he mentions also that the same technique was still employed in his time for building the lunettes in small cellar vaults.

After this practical description, Price explains the more accurate methods: "It should be disapproved [the previous method], in the next Plate is a more accurate method". Then, he explains how to trace the groins for groin vaults of rectangular plans (whose horizontal projection are not straight but sinusoidal lines). This level of detail contrasts with the fanciful methods of Halfpenny, which were copied by other contemporary authors like Batty Langley, Edward Oakley, William Pain, to cite but a few of them, who published numerous handbooks on architecture and building containing Gothic motifs. As an illustration, Figure 6 gather some of these "groinings" (Langley 1763, 169). It is evident that they concentrate on "Gothic forms" to be reproduced at a small scale with lath and plaster, and had no experience in masonry building.

At this time only James Essex (1722–1784), a Cambridge architect and carpenter, attempted to understand gothic arches, vaults and buildings after an



(a)



(b)

Figure 5
Method of constructing a groin vault: (a) Practical method (Price 1735, Plate Q); (b) Scaffolding for a groin vault (Ungewitter 1890, vol. 1, Plate III).

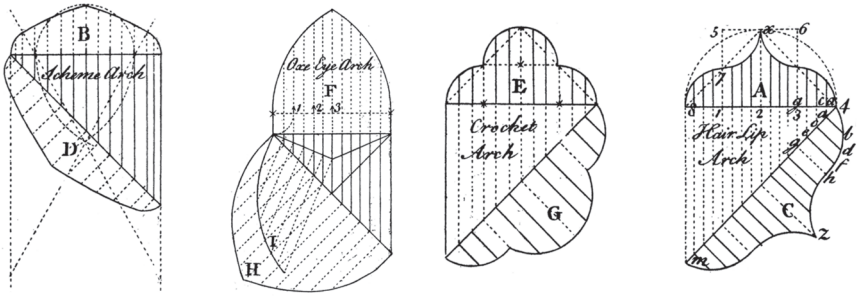


Figure 6
A sample of fanciful arches and groins from a mid-18th architectural handbook (Langley 1763).

exhaustive study of numerous examples, the analysis of the different types of masonry used since Roman times and of documentary sources (he quotes Vitruvius, Beda and Gervase, Alberti, De L'Orme, Palladio, Frézier, etc.).

After years of work and study, James Essex proposed a theory that went on to influence all developments on Gothic in the first half of the 19th century and went even beyond in some aspects. However, this theory was never published. The hundreds of notes and drawings that Essex compiled along his life with the idea of publishing a "History of Gothic Architecture", together with the detailed survey of King's College Chapel, remained unpublished. On his death they were bequeathed to the antiquarian and librarian Thomas Kerrich (1748–1828), who organised the loose folios and pages (near 2,000) and eventually donated them to the British Library forming 15 volumes (see the article of Dominique Lazansky in this book). Kerrich published part of Essex's theories in a note of an article presented to the Society of Antiquarians in 1809 (published in *Archaeologia* in 1812). This was the means of disseminating Essex's revolutionary ideas about Gothic, who, as we shall see, received almost no recognition for them. However, Kerrich's summary is incomplete; he eliminates crucial statements and, in general, was unable to understand Essex's train of thought, which combined the experience of a builder with a deep interest in the probable tracing methods employed by the Gothic masters.

James Essex's background in Gothic construction

Essex was aware of the above mentioned theories on the origin of the pointed arch and criticised them. For him Christopher Wren's Saracenic theory was simply a conjecture, and there was no evidence to support it. As for the interlaced arch theory, James Essex considered that such an absurd ornamentation, with so

little meaning, could hardly have anything to do with the origin of Gothic arches. Finally, the tree theory was considered by Essex to be improbable.

James Essex's approach was rigorous —we may call it "scientific". His ideas were based on the detailed study of many Gothic buildings, some of which he measured and surveyed with extreme care, taking note of their materials, structure and geometry. Three of these buildings deserve special mention because he made extensive interventions in them: Ely and Lincoln Cathedrals, and King's College Chapel. (Cocke 1975)

He worked on Ely Cathedral between 1757 and 1762, contributing to Bentham's monograph on the cathedral (Bentham 1771). James Essex made a very detailed survey of the building and was involved in the restoration of different parts of the building, the roofs, the octagon over the crossing, and parts of the masonry. One of his sketches for the survey has been preserved and shows the level of detail of his measurements, and his attention to the deformations (British Library, Add Ms 6769, fol. 135r). In an annotation below says: "at the springs of the Lower arch Buttresses the 1st stone is cramped to the the wall with iron… the Brick arches which are working within the Arch Buttress have spread the walls." Here Essex mentions the thrust of the flying buttresses against the external abutment and the consequent leaning of the buttress —which was denied two centuries later, for example, by Pol Abraham (1934), as we shall see later.

A technical feat was the use of a large scaffold to raise one of the walls, which the thrust of the roof had moved 60 cm off the vertical, to a vertical position. Essex probably used a similar method to that employed in Beverley 40 years earlier (Cocke 1975, 15). Even today it would be an astonishing technical feat. We reproduce in Figure 7 the scaffold used in Beverley by a carpenter of York named Thornton which, permitted to screw the wall to the vertical (Hiatt 1898, 36); probably Essex used a similar device.

Essex worked also on Lincoln Cathedral between 1761 and 1770, publishing a short monograph in 1776, *Some Observations on Lincoln Cathedral*. It is worth noting that, in Lincoln, Essex demolished and rebuilt the badly cracked chapel of St Mary Magdalen. (Cocke 1975, 16) This meant that Essex had to inspect in detail the masonry structure of the vaults in order to rebuild them. At the end of his monograph on Lincoln Essex praises Gothic construction and laments that in earlier times "it was the fashion to apply the name of Gothic to every irregular or disproportioned building", but that:

> any one, who is properly qualified, will divest himself of his prejudices… and impartially examine the merits of these Gothic buildings… he must acknowledge, that the ancient Free masons were equal to our modern architects in taste for designing… and superior to them in abilities to execute. (Essex 1776, 159).

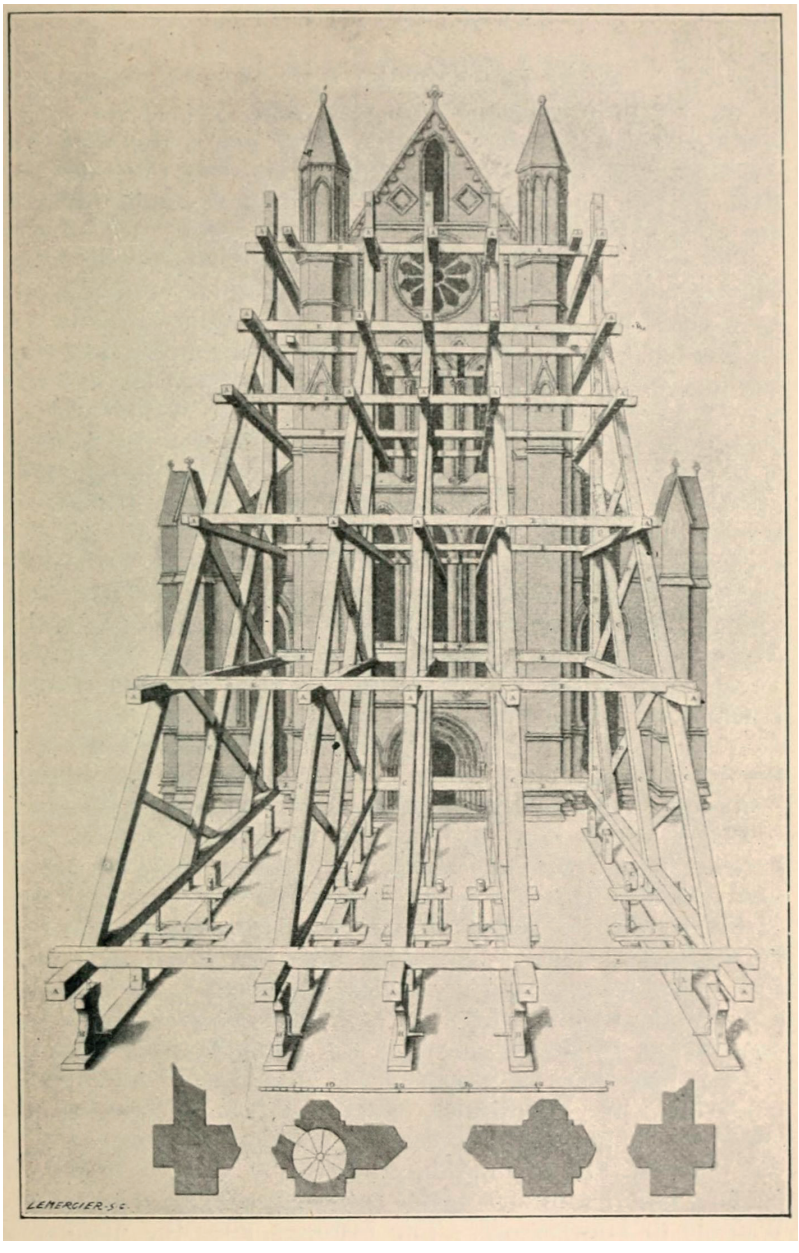


Figure 7
Scaffold used in Beverley to screw back to the vertical the leaning North transept, after a drawing by Geldart in 1739 (Beverley 1898, 35).

As for the Kings College Chapel, James Essex was involved in studying it as early as 1741 (he was just 19 years old) when he made a perspective drawing of James Gibb's design for King's College (Gray 1992, 43). Some restoration work in the 1750s enabled him to take precise measurements and to draw up the geometry of the vaults, arches, turrets, pinnacles, rose windows, etc. Essex planned to publish a book with 15 or 21 plates that he had drawn. The book was never published. As we shall see, the study of these plates, which are preserved in his bequest (British Library Add MS 6772 ff. 1–76), shows that Essex understood perfectly the geometrical tracing of Gothic elements and in particular of fan vaults.

James Essex on Gothic Vaulting

James Essex maintained throughout his career a deep interest in Romanesque (which he called "Old Gothick") and Gothic buildings. He elaborated a complete theory about the probable origin and evolution of the cross-ribbed vault, and what was considered its main element, the pointed arch, from its origins to what he considered his point of perfection, exemplified by the King's College Chapel in Cambridge.

The manuscripts

As has been said Thomas Kerrich received the legacy of Essex and classified and grouped the nearly two thousand loose pages in volumes which he eventually donated to the British Library. Kerrich, as most antiquaries at the time, also had a great interest in the origin of the pointed arch and the Gothic vault. He gathered the most pertinent folios on vaulting in volumes BL Add MS 6762 and 6771. There is a lot of repetition in both volumes, and probably more observations and drawings dispersed in the rest of volumes (which I have been unable to inspect). However, the core of his theory is pretty clear in some pages of the manuscripts above cited. Briefs comments about the evolution of vaulting are found in BL Add MS 6769. Finally, the Essex drawings on King's College are collected BL Add MS 6776.

Essex sometimes wrote in pencil and sometimes in ink. Some texts, written with care in ruled paper, seem intended for publication; others are full of corrections and erasures. Sometimes the pencilled text has been reworked in ink. There are numerous illustrations, sometimes rather well drawn with square, bevel and compass, sometimes rough sketches, illustrating the text. Nevertheless, Essex's theory emerges clearly. In what follows we will attempt to explain it quoting often from the original text. The most important figures have been redrawn from the originals.

Secondary Sources

The first modern study on the architecture of James Essex was made by Donald R. Stewart in his dissertation of 1946, "James Essex, 1722–1784." It is divided in two parts, the first about the life of Essex, the second studies Essex's works in Cambridge's Colleges. There are no specific mention of Gothic arches and vaults. In a later paper, published in 1950, Stewart discussed Essex's deep interest in Gothic, his contacts with Walpole and other antiquarians. For the first time some splendid drawings from his manuscripts were published, though unfortunately the size and quality of printing was poor. Only a couple of paragraphs are dedicated to Gothic arches and vaults (Stewart 1950, 320). These caught the attention to Frankl in his massive work on the *Literary Sources of Gothic*, who expressed his desire that the pertinent parts were published: "It is to be hoped that the whole section of the manuscript now in the British Museum will be published." (Frankl 1960, 403, 501–502)

Nikolaus Pevsner dedicated a chapter to "Walpole and Essex" in his book *Some Architectural Writers of the Nineteenth Century* (Pevsner 1972, 1–8). Most of it, seven pages out of nine, studies Essex's work on Gothic, both his commissions as architect and restorer, and his theories about Gothic contained in his manuscripts. In spite of its brevity, is still a fundamental source as Pevsner studied the manuscripts in depth, making numerous references to them.

The only study on Essex's theories on Gothic arches and vaults was made by Yvonne Jerrold in her dissertation of 1977, "A Study of James Essex of Cambridge, Architect and Antiquarian." In it she dedicates a whole chapter to "Essex's account of the origin of Gothic architecture" (Jerrold 1977, 22–40), where she discusses the contemporary theories of Gothic, the method used by Essex in his studies, his theories on vaults and vaulting and, eventually, the origin of the pointed arch. Though the following exposition is different, the consultation of her work in the Cambridge University Library has been extremely useful for the present author.

The main part of the last contributions to James Essex are due to the late Thomas Cocke (1949–2008), to whom this book is dedicated. Though he didn't address directly Essex's theories on arches and vaults in his publications, he cited it, see the List of References at the end, putting this study in a broader context.

Finally, the "Index on Essex Manuscripts" compiled by Dominique Lazansky should be mentioned, which she has generously shared with the authors of this book.

Roman origin of ancient Gothic (Romanesque) vaults

Janes Essex considered that it was necessary to study the history of construction since Roman times to understand the different changes and the evolution both of the buildings and their elements (pillars, arches and vaults, buttresses, etc.). He studied the different kinds of vaults used by the Romans extracting this information from several Renaissance or Baroque architectural books (along manuscritpts and published papers he quotes Vitruvius, Alberti, Palladio, Desgodetz,...):

> The Romans used 3 sorts of vaults, the most simple was that which Vitruvius calls Fornix [barrel vault] which they generally used in the arches and we find in the chapels of the Temple of Peace [now Maxentius Basilica]. Another kind of vaults used by them was the Fornix angulata, "Cross vault". Of these we find many examples in the pasages of their Theatres, the Great Halls of their Baths, and in some of their Temples, particularly in the Temple of Peace. (BL Add MS 6771, 75r)

After the fall of the Roman Empire, Essex thought that very few changes occurred in the techniques of masonry construction making difficult to ascertain if a building was built in Roman times or later:

> If we examine this Stile of Building and allow for all the variations that must necessarily have been made to adapt it to the various Circumstances of the places it was used in, we shall find that within the Space of near 500 years it receive no material changes except such as must necessarily happen from the variety of the materials and Execution of the work which are found very different in various places and buildings of the same stile and this difference in the Execution wether it proceeds from the nature of the materials or want of skill in the workmen does in many instances produce such an effect, that without carefull examination it is sometimes difficult to distinguish one stile from another. (BL Add MS 6762, fols. 20–21).

He published the conclusions of his life-long study of masonry in Britain in a long paper "Remarks on the Antiquity of the different Modes of Brick and Stone Buildings in England" read before the Society of Antiquaries in 1774 (Essex 1777). There is no space here to analyse the contents of this extraordinary paper, which may be considered one of the first in the discipline of Construction History with its detailed examination of the constructive techniques of constructing masonry (including the foundations) with specific reference to actual buildings and direct inspection; however he does not mention masonry in relation to vaults, only mentioning its role as infil. Contemporary with Essex's study on masonry, Giedion (1971, 80) quotes another two works by Winckelmann (1769) and Ziegler

(1776) which show the same interest in Roman construction and, the latter, also in Gothic construction.

Essex insisted in the survival of building techniques since Roman times: "the same sort of materials and method of working which had been used by the Romans, were used by the Saxons and Normans" (Essex 1777, 81); and later: "wall tiles or bricks were made and used by the Saxons and Normans in the same form and manner as by the Romans" (88) and concluded:

> From this view of the various kinds of masonry used in England in different periods, it appears very difficult to determine the age of a building by the materials or method of using them, when no other circumstances concur to assist us in our judgement. (Essex 1777, 108)

Earliest groin vaults: Roman origin, the groin found "naturally"

Essex considered that the oldest groin vaults were built before the Norman Conquest, in the 10th Century, following the example of the Roman vaults without cross ribs: "The first of these [type of Roman vaults] are what workmen now call groining arches and are commonly found in Buildings particularly those erected in the 10th Century". (BL Add MS 6771, 79v) These vaults were easily built, he says, as the form of the groin is easily found even if the is not a square but a parallelogram. The projection of the groins in the plan are in the first case straight lines, in the second curved lines, as in the choir of St. Paul's:

> Their manner of vaulting was after the plain Roman manner with cross vaults, without bows or ribbs which has in itself a beautiful simplicity, and is easily executed, for whatever the form of the plan the arches being semicircular *the arists or Groins naturally find themselves*, whether the crossing arches were equal or unequal in diameter; If they were equal, the plans of the groins were straight lines, if a small arch intersects a large one the plan was a curve like those in the vaulting of St. Pauls Choir. (BL Add MS 6771, 24r; my italics)

It is interesting the mention that *it was easy to find the groins*. Probably Essex is referring to the methods explained by Price and Mohrmann (see above). His explanation is similar:

> In forming the centers for constructing these vaults, they had no occasion to consider the figure of the Groin, their ribbs being all semicircles or segments of circles, sett on the principal center, answering the principal arches which crossing each other formed the Groins. (24r)

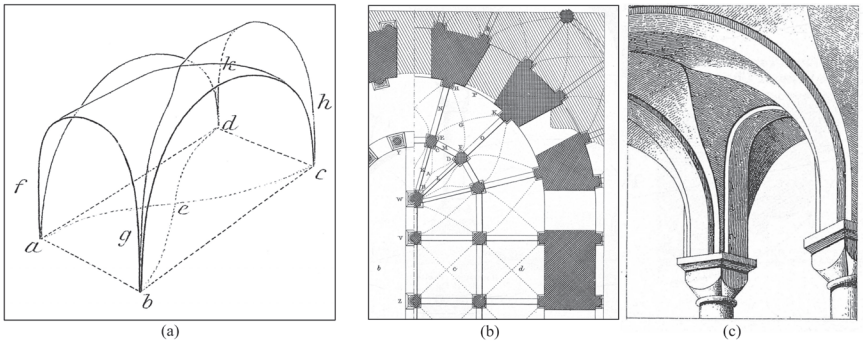
In 1862 Robert Willis studied in depth the formation of groins in his article on the Crypt of Worcester (which he dated in1084) where he could measured and draw precisely as he inspected then in the course of works of restoration an he had not only "freedom of access to every part … but the walls could be scraped and examined without fear of disfigurement and damage." (Willis 1863, 213) Willis concentrated his study in the form and construction of the groins in the apse: "One of the sources of picturesque effect in this crypt is the variety of form of the arches and groins in the apsidal part." (Willis 1863, 215) There, due to fan shape of the webs and unequal span and height of the arches the groins take an "inflected form" —the projections are curved lines with changes of curvature and inflexion points, Figure 8. The intrados of the vaults was "covered by with a thick layer of hard mortar, and the edges of the groins … project from the vaults surfaces with an acute section which gives greater decision to the groin line." He remarked that:

> It is evident that the form of this curve was pleasing to the Norman artist, and although resulting *naturally* from the intersections of the boarded centerings employed to construct his vaults, and not from geometrical knowledge of the science of projection, was appreciated and developed as an element of variety and beauty. (Willis 1863, 215; my italics)

Curiously, Willis used the same expression as Essex referring to the "natural" forming of the groins during construction and observes that "The inflected groin is to be observed in every. Norman, and indeed Roman vault, when the length and breadth of the vaulted compartment are unequal." Willis was the first to note the form of these groins in the vaults of the Baths of Diocletian (Santa Maria degli Angeli e dei Martiri): "It was the observation of this waving groin in the baths of Diocletian, that led me to the discovery of its origin." (Willis 1835, 74) In the same article Willis describes minutely the construction of the masonry of the vaults; there is no space to explore this here, but it will be briefly mentioned later.

Adjusting the height of the arches

There was the problem in adjusting the different heights of the arches and that of the groin. Essex remarks that in the most ancient buildings the arches are seldom perfectly semicircular except in doors, and that this dissimilarity appears more frequently in vaults, though it may appear also when the diameters of the arches of the same arcade are not equal:



(a) (b) (c)

Figure 8
(a) Groins in a rectangular vault with semicircular and stilted arches (Willis 1835, Pl. 2, Fig. 2). (b), (c) Groin vaults in the crypt of Worcester Cathedral (Willis 1863, details of Pl. 1).

> It is observable in Gothic Buildings that the arches are seldom perfectly semicircular, except in doors or windows, especialy in those places that are vaulted, or where several arches are placed in the same range upon pillars at unequal distances, as in the porticos of Churches, where the pillars are often ill set out, and very unequal in their divisions and when those porticos are vaulted as is often the case, unless the plan of the vault is square the arches will be different in diameter. (BL Add MS 6762, 49)

He mentioned two methods: either to raise the centre of the semicircular arch about the level of the impost or to stilt the arch prolonging its springings with vertical lines until it reaches the adequate height. He mentioned as examples of the first method Peterborough Cathedral, Figure 9 (a), and, curiously, the Roman Pantheon, where he misinterprets —probably led by his desire to relate the origins of Gothic with Roman architecture— as horseshoe arches, the projection of the relieving arches in the walls of the tambour in the elevations of Desgodetz (1682), quoted in BL Add MS 6771, 23v, Figure 9 (b). For the lengthening of the springings, he gave the example of the Roodloft in Ely cathedral, which he surveyed before its removal, Figure 9 (c).

It is worth quoting Essex in full with reference to one of his drawings:

> Whenever that happened either by this or any other cause, they endeavoured to make them equal in height, this they sometimes did by takeing a center above the impost of the greater arch and making the lesser more than a semicircle —[Figure 10 (a)], as may be seen in Peterborough Cathedral and other places, this indeed brought the arches all to the same height, but produced a very bad effect (though it was practiced in the pantheon at

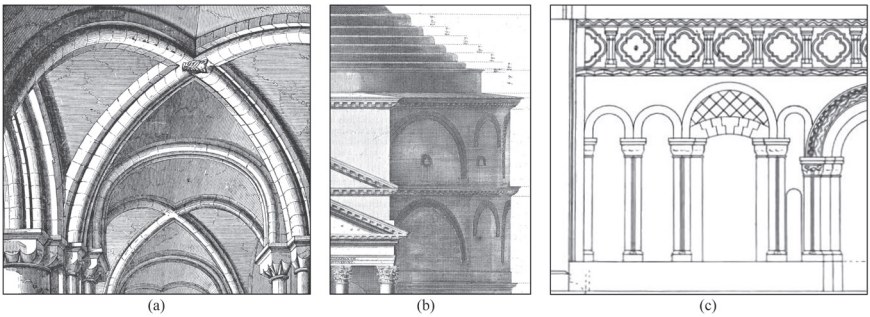


Figure 9
(a) Horshoe arches in the Peterborough Cathedral (Parker 1877, 80). (b) Relieving arches in the tambour of the Roman Pantheon (Desgodetz 1682, 13, detail). (c) Stilted arches in the Roodloft of Ely Cathedral redrawn by W. H. S. J. Hope after Essex's sketches (Hope 1917, Pl. 8, detail).

> Rome, one of the finest remains of Roman architecture in the world). Another method of Rectifying this defect was by lengthening the extremities of the arch with straight lines— [(Figure 10 (c)] of which we see many instances, and some in Ely Cathedral particularly in the front of the old screen or Roodloft. (BL Add MS 6762, 49)

Essex considered that horseshoe and stilted arches function very well until they were displaced by the pointed arch: "This method did tollerably well, whilst they found the necessity of using the pointed arch" (49). Essex's interest is shown by the numerous sketches in the manuscripts in which he compares the three solutions.

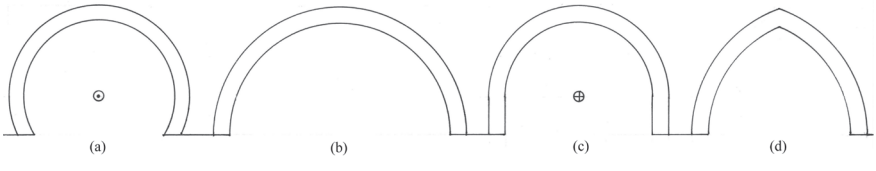
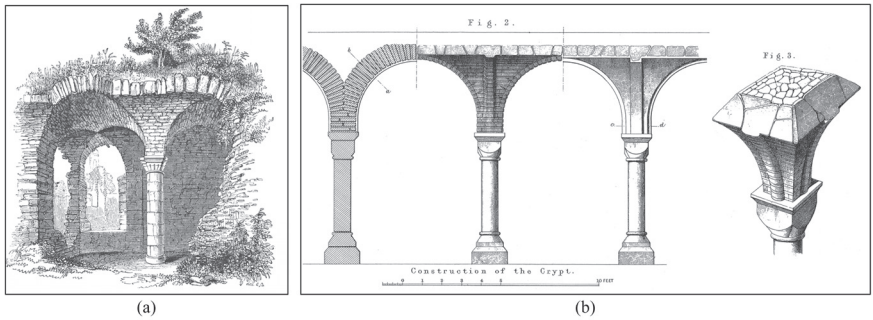


Figure 10
Essex sketches on the different ways to adjust the height of arches (redrawn after BL Add MS 6762, 48).

The origin of the cross rib vault: the centering

After discussing the construction and geometry of the groins, Essex made a crucial observation: the centers for groining vaults must have been extraordinarily strong to support the enormous weight of these "Roman" vaults (Essex

says “arches”; it should be noted that Essex frequently used the word “arch” instead of vault when referring to the masonry shells between groins or ribs) until the vault was completed. The construction of the oldest groin or rib vaults is difficult to ascertain except when they are in a ruinous state Figure 11 (a). As mentioned before, in 1863 he published a detailed description of the construction of the vaults of Worcester crypt, Figure 11(b). However, here the ribs were constructed at the same time as the vault shells, with great stones with a protuberance which was afterwards covered with plaster forming a rectangular rib, *Fig. 3* in Figure 11 (b). This, Willis remarks is a difference with the ribs in the crypts of Winchester (1079), Gloucester (1089) and Canterbury (1096), where the arch ribs are built with regular voussoirs. Were those embedded ribs the precedent for independent ribs?



(a) (b)

Figure 11
Construction of groin and early rib vaults: (a) Ruins in Sherborne Castle, 1115-1139 (Parker 1877, 79). (b) Worcester crypt, 1084 (Willis 1863, Pl. 2).

Essex concentrates in the origin of independent voussoir groin ribs executed on light centering prior to the construction of the vault webs.

> It was necessary however , in these sort of arches that the centers should be very strong for the vaults being composed of heavy materials such as wall tyle (ressembling Roman brick) or stones in the same shape, required a good support, until all was keyed in … (BL Add MS 6771, 24r)

Besides, after completion, the vault needed some time to set (it may take months if the masonry is thick), with the consequent lose of time, and during this time it was exposed to weathering (rains etc). All these problems might have led the builders to build the first the cross ribs, which required less centering and which

could be removed as soon as the vault was completed as the cross ribs supported the whole weight:

> … they stood some time to stiffen which being attended with exposure and loss of time, might putt the builders upon forming the bowed or cross rib vaulting such as are very common in buildings erected soon after the conquest. These required less center than the other, and might be struck as soon as the vaults was turned as the Ribbs supported the whole weight. (24r)

Essex was an experienced builder and his observation is probably true: the joints between the voussoirs are thin and probably the masons used small wedges to set the stones in position. As the stresses are low, these wedges may make the arch almost "rigid" after decentering.

Here, for the first time, appears a rational theory of the origin of the cross vaults, predating by almost a century the one of Viollet-le-Duc (who called the ribs *cintres permanents*), as will be discussed later. Essex, and Viollet-le-Duc, have inspected and rebuilt many vaults; both arrived to the same conclusion. The only difference is that Essex formulates the theory as a *possibility* while Viollet-le-Duc considers it *true*.

Ribbed bridges

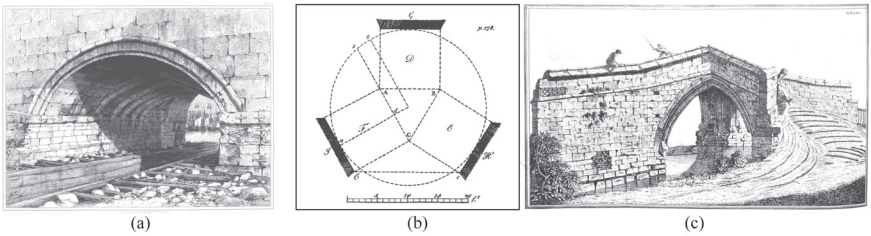
In another manuscript, Essex remarks that the method of building upon arches or ribs, because of the sparing on centering, is also adequate for bridges and quotes as an Example the London Bridge (Fig. 12 (a)):

> As this method of building upon bows required very little centering it was very convenient for arches of large spans, such as Bridges, to which they afterwards applyied it with good success, as may be seen in London Bridge, and many others, where the bows are placed parralel to each other at convenient distances for turning the arch over them. (BL Add Ms 6762, 53)

Essex built two stone bridges in Cambridge. The Great Bridge, built in 1754 and demolished in 1831; and the Trinity College Bridge, 1763-1766 (Jerrold 1977, 48–49) with cycloidal arches, an idea which he may have taken reading Frézier (the quotation from Frézier is not in the studied manuscripts, but Pevsner (1972) says that Frézier is quoted in some manuscripts) who describes the way to draw this curve (Frézier 1738, 100).

A year before his death, Essex wrote a brief note on the triangular bridge of Croyland (Essex 1783) also with ribbed vaults, "a curiosity, worthy notice for the

singularity of its form, more than its extent, or any difficulty in the construction" Figures 12. In it he gives the main dimensions and produce a scheme with the tracing of the plan of the vaults and also the form of the arches and ribs, Figure 12 (b). He mentions a similar bridge in France, the Pont Sans-Pareil, in the road between from St. Omer's and Calais, which he saw in his travel to Flandres in 1773 (Essex 1888, 70).



(a) (b) (c)

Figure 12
Ribbed bridges: (a) Old London Bridge, Long-Entry-Lock (E. W. Cooke. British Museum, Heal,Topography.62); (b) Tracing of the Croyland Bridge (Essex 1783, 178); (c) View of Croyland Bridge (Gough 1783, Pl. VI, 107).

The tracing of the cross ribs and the origin of the pointed arch

After considering the origin of the cross ribs, Essex examined the problem of tracing the groin to cut and build the cross arches. The form of the groin, that previously "naturally find themself" from the construction of the intersecting barrel vaults, must now be found in avance. We know that to construct a voussoir arch it is necessary to trace its profile in real size for the masons to make the templates and cut the stones of the arch. There are many examples from medieval times of this kind of tracings inscribed on a wall or on the floor; some cathedrals had even tracing rooms. (The literature on Gothic tracing is abundant, see for example Müller (1990), Rabasa (2000), Palacios (2009), Wendland (2019), Buchanan et al. (2021).)

The intersection of two semicircular barrel vaults is an ellipse and the builder of these first cross vaults were completely ignorant of this curve. In groin vaults the ellipse was obtained during construction, but the geometry of the rib had to be defined in advance to enable the stones to be cut and the centerings constructed. Essex claims that medieval masons approximate the intersection to a "common semi-oval", a curve very-easily traced:

> The principal difficulty in this sort of vaulting was to forme the cross ribbs which in a perfect semicircular groined vault should be eliptical, a curve which they were not ac-

> quainted with but instead there often used the common semi oval a figure which they could construct with almost the same ease as they did a semicircle and this they generaly used for the Cross ribbs of their vaults. (BL Add MS 6771, 24v)

The semi-oval to which Essex refers is the fourth oval of Serlio (1544, I, 18v) as is represented in Figure 13 (a). In Figure 13 (b) the letters correspond to Figure 14.

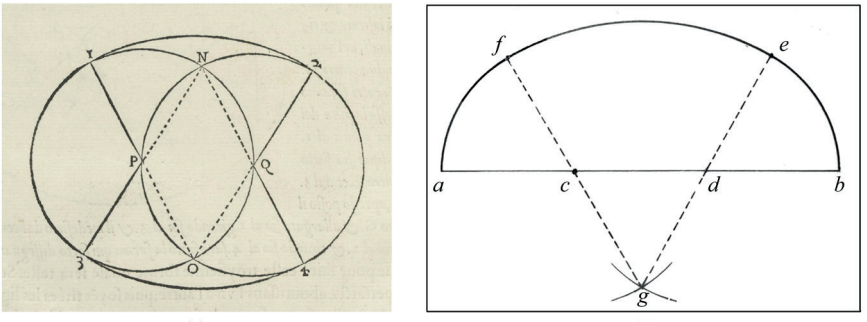


Figure 13
(a) The fourth oval of Serlio (Serlio 1544, 18v); (b) Tracing the semi-oval (cf. Fig. 9).

Essex remarked that, however, the oval cross rib is higher than the semicircle. In constructing the vault upon the ribs —that is, tracing horizontal lines perpendicular to the planes of the semicircular arches— the curve obtained is not concentric with these semi-circular arches and to adjust the height they formed pointed arches:

> … when the vault was turned upon the ribbs, it was by no means concentric with the semicircular arches (which they continued to use with them) even in those places where the plan of the vault was perfectly square they frequently formed pointed arches over the round ones. (24v)

He considered this matter crucial and he produced dozens of sketches trying to explain the problem. Some of them are nicely drawn and seem intended for publication. In Figure 14 we have redrawn one of them in BM Add Ms 6762, 52 where the problem is first graphically explained; there is a legend at the bottom of the page with explanations, which we have transcribed.

The oval cross rib is higher than the semicircular arches on the sides of the square plan. Then, to reduce this difference Essex propose to use pointed arches formed joining two segments of the oval cross rib. Essex explains the

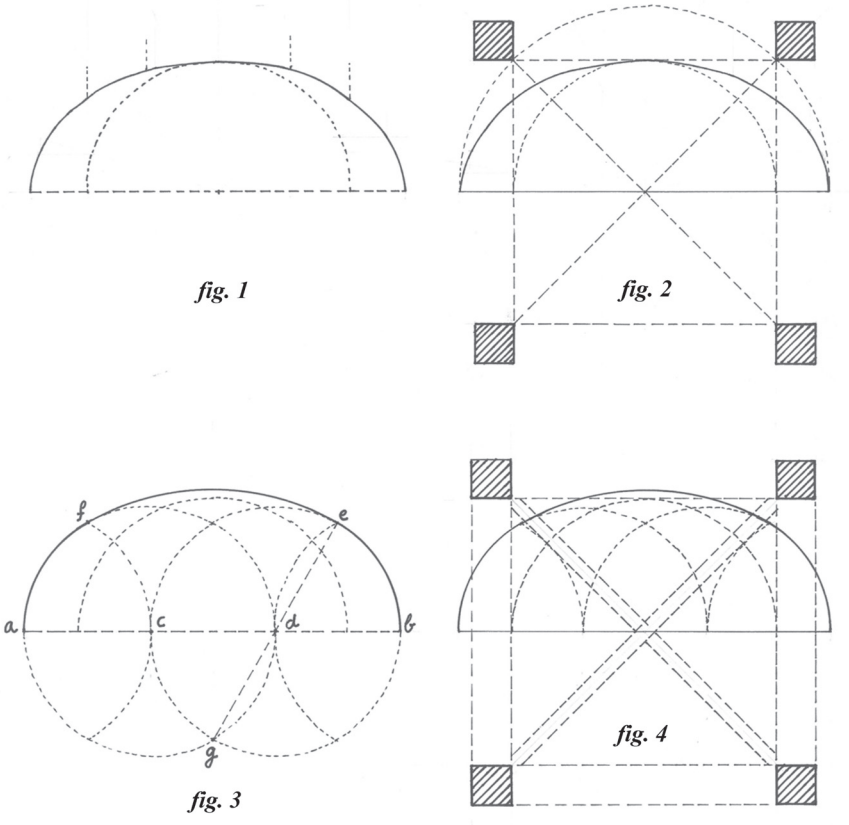


Figure 14
Essex's explanation of the use of ovals instead of elipses fro the cross ribs (redrawn from BM Add MS 6762, 52). The text at the bottom of the page: "In fig^{r} 1 is the Elipsis which the angle of the Groin makes when the Vault is formed by 2 semicircles crossing at right angles upon a square plan, fig^{r} 2. In fig^{r} 3, is an oval, formed upon the Diagonal of the square plan fig^{r} 4, used insted of the Elliptical arch fig^{r} 1. It is formed by dividing the length of the Diagonal (*a*.*b*) into 3 equal parts one of Which being taken for the radious on *c* and *d* describe to intersecting circles, likewise on *a* and *b* 2 segments, on the point of intersection *g* with the radious *gf* draw *fe* which compleats the fig^{r} *afeb*."

geometrical process in Figure 15 (BL Add MS 6771, 26v). The text which accompanies the figure in the manuscript is as follows:

> The arch *E* is found by the plan in [the] figure *A* draw the diagonal *ef*.*gh* and divide *ef* into 3 equal parts at *a* and *b.* Make the equilateral triangle *acb*. Draw *ei* and *ck,* and from the

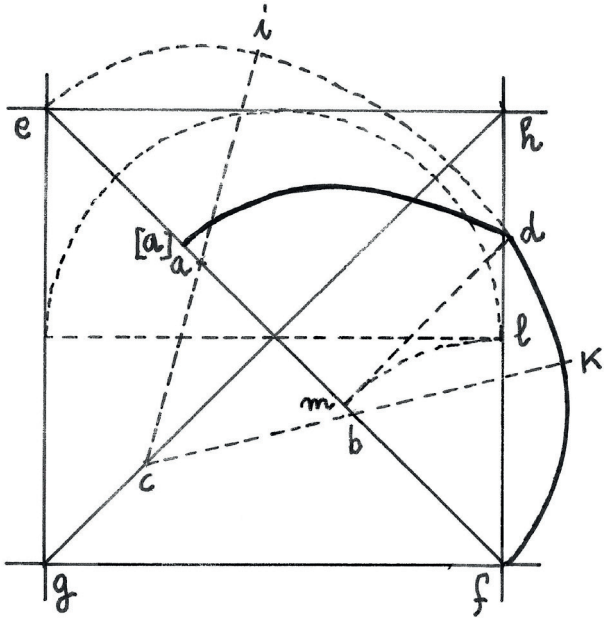


Figure 15
Tracing of the pointed arch over the semicircular arches of a square cross vault (Redrawn after BM Add MS 6771, 26v, Figure A; corrections added between brackets; pointed arch in full-line).

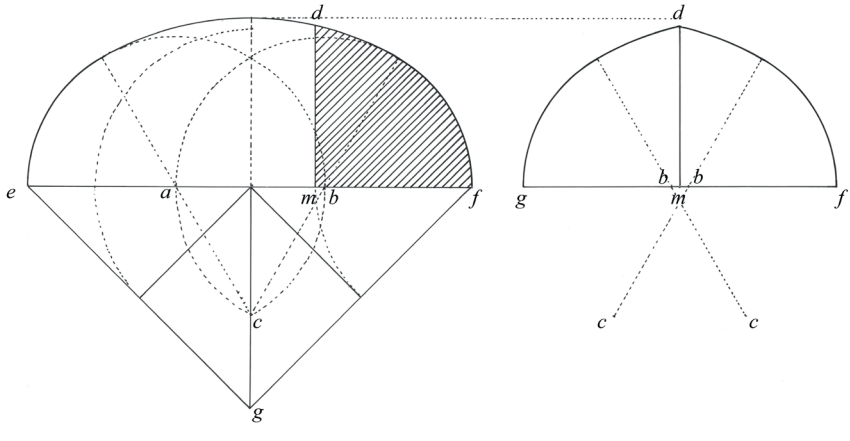


Figure 16
Explanation of Figure 15.

> centers *c a b* describe the semi oval *eidf* , which will be the principal rib. Make *fm* equal to *fl* and raise the perpendicular *dm* which cuts off a segment of an al equal to half the arch *al*. Two of which *adf* put together form the arch which is made over the semicircle.

The construction is not entirely correct as points *m* and *b* do not coincide and the semiarch is not *am* but [*a*]*m* as indicated in the drawing, but the difference is minimal and is absorbed in the rough sketch of the original manuscript drawing. The forming of the arch is explained in Figure 16.

What is crucial here is that the shape of the vault over the semicircular arch is obtained from the crossing arch, by cutting off the part of the arch that corresponds to half a perimeter arch, and joining it with a symmetrical one. Probably he is following an old practical method: the stone masons had to draw first on the floor the tracing of the cross rib to fabricate the templates for cutting the stones. The profile already drawn is used to obtain the new profile without the need for a new layout. The pointed arch obtained is slightly lower than the crossing rib (Fig. 16), about 7%, a quantity which is irrelevant in practical construction.

Essex claims that this coincides with his observations on the oldest cross vaults: "We observe the first pointed arches very little pointed, because they were at first naturaly so from the use of the semi oval for the groins." (BM Add MS 6771, 13v)

The problem now is that the pointed arches produced by the oval cross ribs have irregular faces, as the intrados and the apparent extrados are not concentric. Essex comments that this defect was not so important when the arches have few mouldings, but that when the mouldings increased the only way to maintain them concentric was to use pointed arches:

> This irregularity in the faces of the arches was little regarded while they used plain ribbs and arches with few mouldings but when they began to use many mouldings and to be more nice in the execution of their work they must have discovered this defect but they could not remedy it any way but by [24v] forming their arches to suit those which their vaults produced. Thus they accidentally as it were stumbled upon the pointed arch which being at first found useful afterwards became fashionable. (BM Add MS 6771, 24v, 27r)

Essex considers the problem of moulding as crucial and discusses it in several places of the manuscripts consulted, including again dozens of sketches. In Figure 17 we have redrawn a series of sketches, a continuation of the ones in Figure 14 above. The drawings occupied one folio (BM Add MS 6762, 54) and the text at the bottom says:

(a) Figr 5 is the Curve of the Diagonal Cross rib formed in the same manner of figr 3: Two segments of which make the pointed arch *abc* over the round one. When the diagonal ribb was made a semicircle as in figr 7 the arches being made of segments of the same Curve formed the pointed arch figr 8.

When they used many mouldings on a circular arch, and cross ribbs

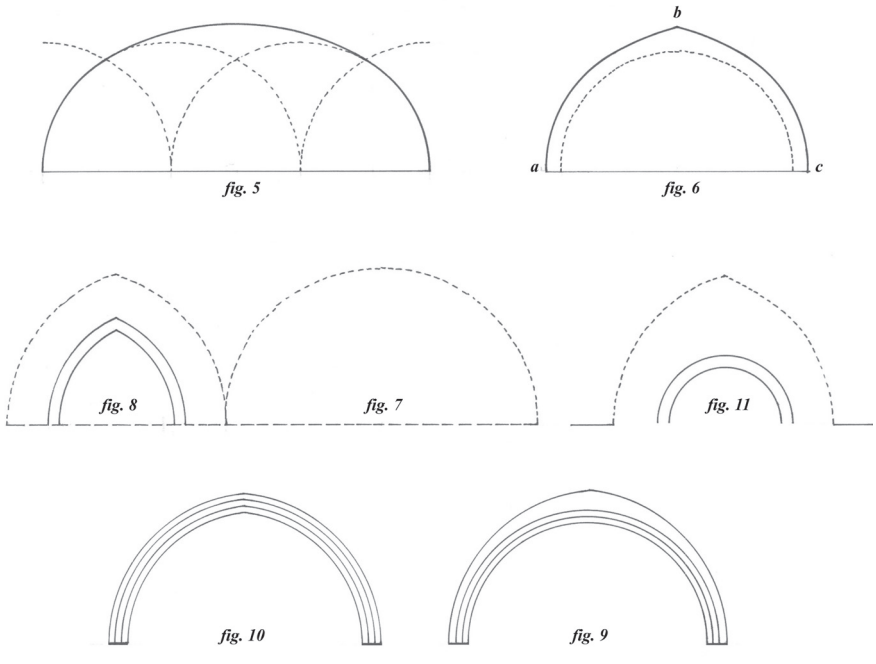


Figure 17
The problem of mouldings and the origin of the pointed arch. Figures redrawn from BM Add MS 6762, 54.

they would appear as in figr 9 which having a bad effect was altered to figr 10 which compleated the pointed arch.

(b) A circular window under a pointed vault as in figr 11 could not have a good effect therefore it was necessary to make them as figr 8

Once the pointed arch was admitted it was very easy to adapt the different

arches of the cross vaults following any conditions, using frequently segments of the greater arch:

> The pointed arch could not rise much above the semicircle at first on account of the oval form of the Groin ribs being very flatt, but when they formed the ribbs of curves rising higher, the pointed arch grew higher with them. (BM Add Ms 6771, 27r)

The tracing of pointed arches

Once the pointed arch was invented it was necessary to find a simple method to trace a pointed arch of any diameter and height: "Our masons soon discovered the convenience of these pointed arches and soon found a method of describing them of any height and diameter." (BL Add MS 6771, 59r)

Essex accompanied the text with a rough sketch, Figure 18 (a) and precise instructions:

> the diameter *ab* and height *cd* being given with any opening of the compasses, from the points *c b* and *b* describe intersecting arches *ee* and *ff* and through *e* and *f* draw lines *efg* cutting the diameter continued in *g* and the points *g* and *g* will be the proper centers for describing the arch proposed. (BL Add MS 6771, 59r)

Then Essex remarks that the pointed arches whose centres result from a division of the diameter into equal parts are "regular", and cites as examples the Italian arches *di terzo* or *di quarto acuto*, Figure 18 (b); when the centres are not so located, they are "accidental"; these centres may be within or without the diameter:

> … from this regular division of the diameter into equal parts they may called *regular pointed arches* in opposition to those which are described from *accidental centers* either within the diameter or without it. (my italics)

Besides, continues Essex:

> for all pointed arches raised[?] from two centers must be described with radii greater than their semidiameters, hence an infinite variety of pointed arches may be described on the same diameter but differing in height, or of the same height but differing in diameter.

Essex claims that once the rule was discovered and applied to vault arches they began immediately to use it for arches in doors and windows, and the Saxon and Norman masters abandon semicircular arches:

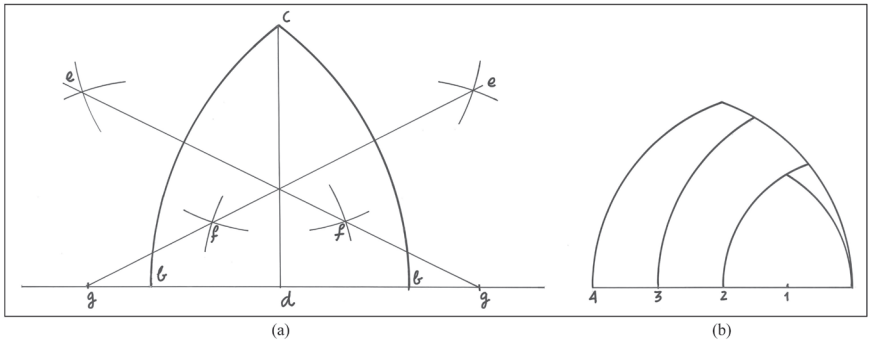


Figure 18
Tracing pointed arches: (a) Rule to trace any pointed arch of given diameter and height. (b) Pointed "regular" arches "di terzo" or "quarto acuto". (Redrawn after sketch in BL Add MS 6771, 59r).

> This rule being established among the appareilleurs for describing pointed arches of this kind they began to apply them to doors and windows instead of the semicircular arch which was used by the Romans and after them by the Saxon and Norman masons. (BL Add MS 6771, 59v)

Though the rule allows complete freedom of design, Essex shows in the manuscripts a great interest in finding "regular" solutions to the different problems (as is evident in the examples of Figs.

The modern reader, who has studied simple metric geometry in the school, may consider this rule as self-evident. It was not. After the fall of the Roman Empire the knowledge of practical geometry almost disappeared and was slowly recovered —Euclid was rediscovered in the 12th Century (Bulmer-Thomas 1979). However, medieval masons were only interested in practical theory, geometrical methods or rules to solve practical building problems (Shelby 1972). What is astonishing is the speed with which these illiterate stonemasons assimilated and exploited the rules of practical geometry, arriving at solutions of enormous complexity.

"As this opinion of pointed arches is new…"

Essex was conscious that he was breaking new ground. One can imagine him hearing, maybe with a certain impatience, the discussions of his antiquarians friends about the popular theories (the tree, interlacing arches and saracenic theories) which circulated widely through the last half of the 18th Century. John Britton (1771–1857) made a review of the theories about the Gothic (which he called 'Ec-

clesiastical architecture') up to the beginning of the 19th Century; along 70 pages he minutely studied and resumed 66 sources (Britton 1826, 31–102). At the end of his essay he shows his impatience about the state of the art, for the endless repetitions of "opinions" and "theories":

> It seems an almost endless endeavour to analyze and explain the systems, opinions, and theories of different writers on the subject now under review. Every author thinks it necessary to retrace the ground of his predecessors, either to controvert their inferences, or to enforce them by additional argument or evidence. Hence the reader is involved in much repetition, and taxed with occasional irrelevant matter. (Britton 1826, 102)

Probably Essex felt the same. His contemporaries though recognised his extraordinary technical knowledge about Gothic architecture, did not appreciate the depth of his theories. Michael Tyson in a letter to Richard Gough, both members of the Society of Antiquaries and friends of Essex, said succinctly: "Mr Essex hypothesis of the cross-ribbed vaulting, is too refined to bear talking about." (Tyson to Gough, 29th March, 1779. Quoted by Jerrold 1977, 38).

Essex is usually very moderate in his comments, but sometimes he appears to have lost his temper, as when he commented on the interlacing arch theory (beloved by many, among them his friend James Bentham). The following sentence appears, copied twice in different manuscripts:

> Among the very great variety of ridiculous ornaments which distinguish Buildings of this Gothic Age there is no one more remarkable than the intersecting arches, an ornament so absurd and of so little meaning that it is difficult to find ant thing that could give them to the first idea of it. (BL Add MS 6771, 28v; Add MS 6762, 46)

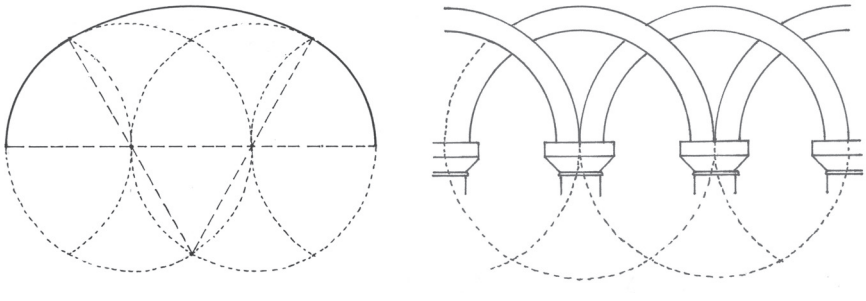


Figure 19.
Origin of the interlacing arches from the construction of the oval cross ribs (illustrations redrawn from BL Add MS 6771, 54r).

Indeed, Essex believes that the origin of interlacing arches comes after the pointed arch, directly from the construction of the semi-oval, and he continues:

The time they were introduced was about the same as the cross ribbed vaults, and the method of describing the cross ribbs might probably give them the first idea of this, a very few lines added to those necessarily wanted in the construction of that figure would at once produce this ornament.

In other folios he made drawings to establish more clearly the comparison, Figure 19.

Essex was fully aware of the importance and implications of his theories and

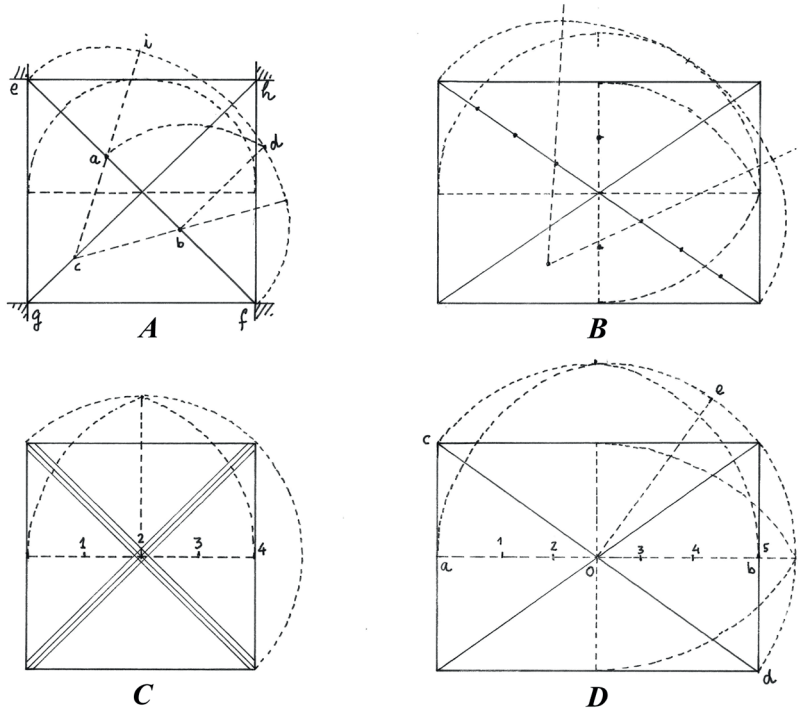


Figure 20
Redrawn after BM Add MS 6771, 26v, Figure 20.The figures A-D have been reordered for convenience to the reader. Figure A was reproduced above as Figure 15.

writes:

> As this opinion of pointed arches is new it will proper to illustrate what has been said upon the subject by adding the following figures, by which it will easily appear how the pointed arch was first formed and the progress of it. (BL Add MS 6771, 27r)

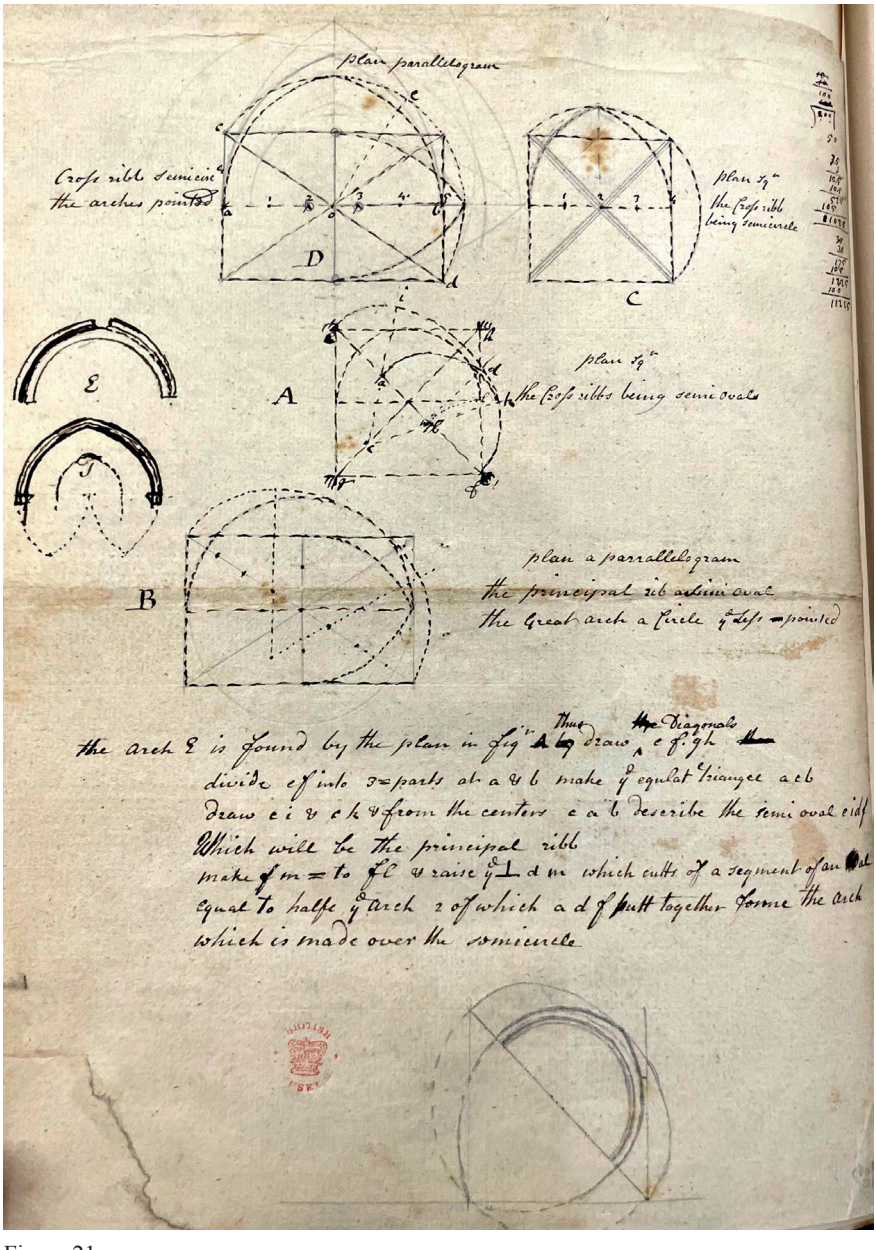


Figure 21
Some sketches describing different solutions for cross ribs. Note also *figs*. *E* and *F* for the problem of mouldings; at the bottom, a rough sketch of the arch with intrados semicircular and extrados pointed (BL Add MS 6771, 26v)

and in the next page gathers a series of examples which has been redrawn in Figure 20. In Figure 21 has been reproduced the corresponding folio in the manuscript.

Essex reviews the more common situations of cross arch quadripartite vault (Figures 19, 20):

- *A*: "Plan square, the cross ribbs being semi ovals." The tracing have been discussed above (Fig. 15): an oval cross rib and perimeter arches pointed, formed combining two segments of the oval.
- C: "Plan square, the cross ribb being a semicircle." The perimeter pointed arches are obtained dividing the side of the square in four equal parts and taking 2 and 3 as centers for the branches of the pointed arch. For Essex the arch is, as we shall see later, "regular". The height is exactly half the diagonal.
- B: "Plan parrallelogram, the principal rib a semi oval; the great arch a circle; the lesser [arches] pointed." The transverse arch (called "principal rib") is a semicircle. The proportion of the parallelogram is $1:\sqrt{2}$. In this way, the small arch can be obtained dividing its diameter in four parts as in case C. Finally, the cross arch is obtained dividing its diameter in eight parts. With the two points near the centre an equilateral triangle is formed which defines the semi-oval as shown in Fig. 19 (C). The height of this semi-oval is almost exactly the radius of the principal arch (with an error of less than 1/1000!).
- D: "Plan parallelogram, Cross ribbs semicircle, the arches pointed." The parallelogram has the same proportion $1:\sqrt{2}$. The diagonal arch is a semicircle. The smaller arch is exactly of the third point, that is equilateral, the centers at the extremes of the diameter. To obtain the centres of the great transverse arch, the drawing by Essex shows some doubts. It appears that he divides the diameter in five parts, numbering the divisions 1, 2, ..., 5, the centres being in points 2 and 3. The construction is not exact; the height of the arch is a little less than the radius of the semicircle (an error of 3.4%), quite small but still visible in a drawing by square and compass. The divisions shown in the manuscript are not equal and it turns out that dividing the diameter in four parts and taking the centres at 1/8 of the centre of the diagonal, the construction is exact. In the original manuscript there are several trials in pencil, hardly visible. I believe that Essex —like the present author who discovered this property after some trials— was looking for an exact geometrical construction. Of course, from a practical point of view an error of 3.4% is irrelevant.

Another construction for a quadripartite vault of rectangular plan was discussed by Essex in another manuscript. In this case, the proportion of the rectangle is 1:2, a proportion very common for the vaults of the central aisles in three-aisle

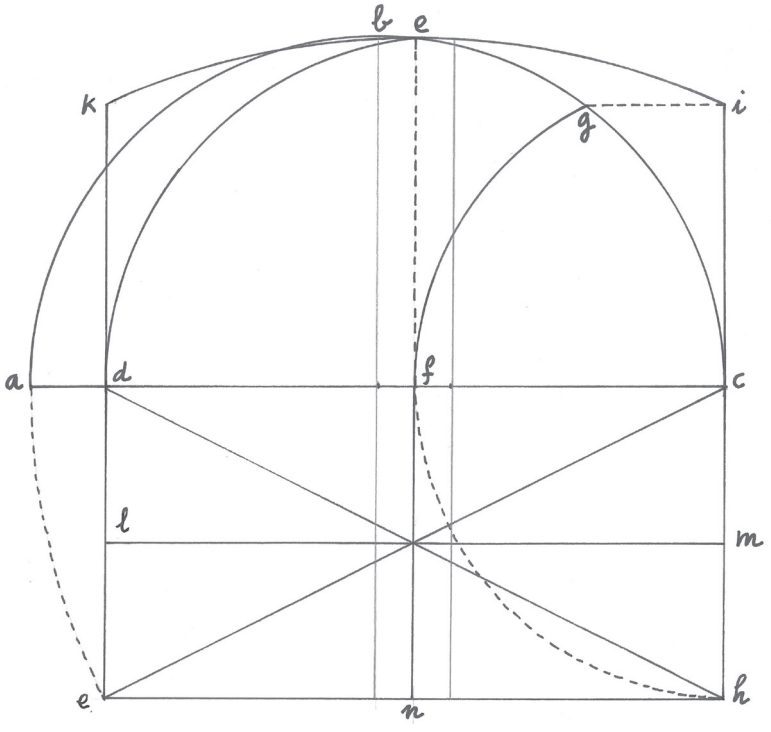


Figure 22
Tracing of a quadripartite vault of rectangular plan of proportion 1:2, the diagonal rib semicircular (redrawn after BL Add MS 6762, 121)

churches, being the plan of the lateral aisles square. Essex tracing has been redrawn in Figure 22.

I quote the text of Essex at the bottom of the folio:

> when the plan of a vault is a double square as is usual in the middle Isle The diagonal ribb being made a semicircle *abc*, whose plan is *ec* The *principal arch dec* will then be but little pointed. The arch *f.g.e* whose plan is *ch* will be made of 2 segments of the arch *abc*. The flat arch *kei* whose plan is *lm* is the segment of a large circle whose 3 points *k.e.i* are determined by the points of the Arches *g* and *e*. NB. The crown of the arch from *l to m* is sometimes level and the arch *fgc* raised to the height of *e* as in the Presbitery at Ely. The rib *fn* will be a straight line. (BL Add MS 6762, 121, my italics)

The main point in this text is that there is a "principal arch", in this case the diagonal, from which the rest of arches are produced. The great transverse arch

dec has the same radius as the diagonal and the centres are marked in the figure by two vertical lines. The small arch *fgc* has also the same radii of curvature. The height of the great arch is less, but very nearly that of the diagonal arch (with a minimal error of 0.6%), but the height of the small arch is much less. (Viollet-le-Duc (1854, vol. 4, 90) claims that this kind of tracing appears in France circa 1230 for the vaults of rectangular plans.) Then, Essex comments that sometimes both ridge lines *lm* and *fn* are made horizontal and that this pattern was common in the time of Henry III (1216–1272) with the addition of more ribs:

> This sort of vaulting with the addition of several plain ribbs, was much used in the time of H[enry] 3^{d} and succeeded the simple cross vault with bows – we find it in the Eastern part of Lincoln and Salisbury Cathedrals. If any other ribbs are added they are segments of circles whose centres are always found upon the line *ca*.

Principal arches

The expression "principal arch" appears several times in the manuscripts. Sometimes Essex used it to designate the transverse or cross ribs, but as we have seen in this case the principal arch serves to generate the rest of the ribs. This is the main main meaning of the term and Essex is quite explicit about this: "Pointed arches making parts of a vault should be governed by the *principal arch* though there are examples to the contrary they are not commendable." (BL Add MS 6762, 114, my italics) A few lines after, he insists: "In vaulted buildings all the arches that can possibly be affected by the vault should be determined by the *principal arch* though it is not always found so." (my italics). And immediately afterwards Essex affirms that when Gothic design reached more perfection the principal arch governed the whole design, including the tracing of the tas-de-charges, the formerets and the rest of the construction connected to the vault:

> When they began to be very curious in the designes of their vaults it was usual to make all the parts conformable to it [the principal arch] and after giveing the building its proper forme to design the vault and make the parts below correspond with those intended above thus they were able to set the tases d'charge and formerets of their vaults with the other parts of walls and turn the vaults after the building was covered in. (BL Add MS 6762, 115)

As shall see, Essex considers that this perfection was reached in the design of King's College Chapel vaults which were constructed using only three all taken from the principal arch:

> In constructing this vault there are no more than 3 curves necessary all the rest being parts only of the same arch. The *principal arch* on which all the rest depend is that which runs from *a* to *b* and from *c* to *d* [the diagonal arch] all the other ribbs are segments only of this being proportional to the length of the several radii. . .” (BL Add MS 6771, 82r-82v, my italics)

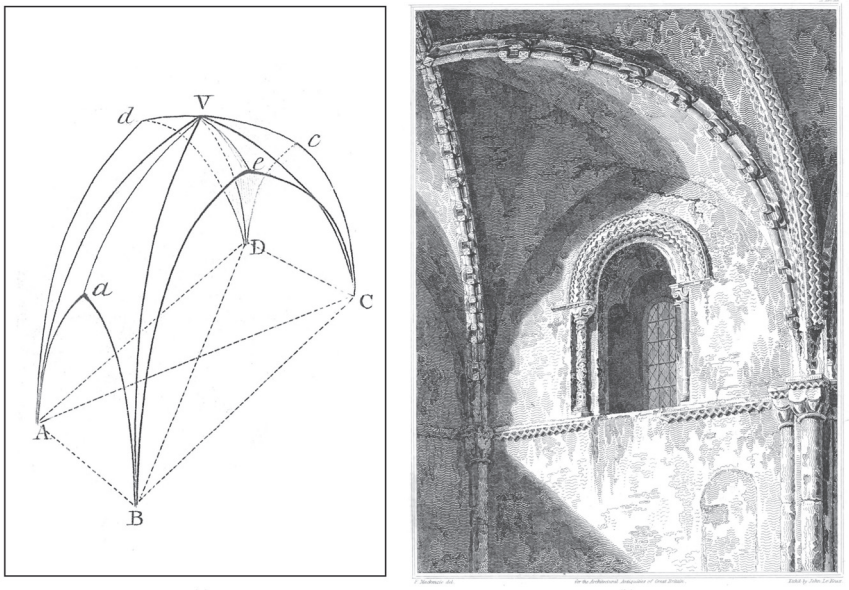
The same method of using a “principal arch” to determine the rest of the ribs in a gothic vault appears in German late-gothic. It appears in some manuscripts of the end of the 15th Century (Brändle 2010). The method was published the first time in an obscure late treatise on gothic vaults from the end of the 17th Century (Ranisch 1695). His author Balter Ranisch (1648–1709) was a mason and “bürger” of the city of Danzig (today Gdansk) and the book describes the construction of the vaults of the churches of Danzig. In each vault there is a “principal arch” (*Principal-Bügen*) from which the rest of the ribs are derived. The interest in the role of Pricipal Arches in late-gothic vault design revived in the second half of the 19th Century, being studied by Hoffstadt (1840), Ungewitter (1859) and in particular by Karl Mohrmann in the third edition of Ungewitter’s (Ungewitter 1890). The method was studied by Meckel (1933) and then forgotten. The matter was revived by Werner Müller in the 1970s; the whole development in Müller (1990); see also, Nußbaum and Lepsky (1999).There are several recent contributions on this topic; see for example, Pliego de Andrés (2017).

Is this a mere coincidence that both in England and central Europe the same name and approach appears? The matter exceeds the limits of this chapter, but it suggests some kind of connection between English and continental Gothic. Nicolaus Pevsner (1959) speculated that there must have been transmission of Gothic vaulting design from England to Germany, and this produced a debate that it is still alive (Becker-Hounslow 1998).

The evolution of the cross vault: the change in the construction of the vault webs

Essex also comments on the evolution of the cross vaults in England. The first cross vaults appeared in the crypts and lateral aisles of the churches. They were usually of small size and with the springings not far from the floor. This would have facilitated to support the centering directly on the ground. Their construction was, as we have seen, very heavy with thick shells of ragstones with thick mortar joints; in the case of crypt vaults with a filling forming a horizontal extrados.

However, to buttress the thrust of these heavy vaults was not difficult due to the small spans of the vaults and low height of the pillars. When it came to building the high vaults of the central aisles something should have done to avoid an



(a) (b)

Figure 23
Quadripartite vault with domical webs. (a) Scheme of rectangular bay (Willis 1835). (b) Chancel of St. Peter's Church, Oxford, 13th Century (Britton 1807b, Pl. 2)

enormous cost both in masonry and wood centering. To solve this problem, Essex remarks that it was necessary to modify both the form and construction of the webs:

> Whilst the common cross vaulting with 2 ribbs was used they had not attempted to vault any more than the portico or side aisles of churches. When they attempted the middle aisles it was necessary to contrive another kind of vaulting and instead of the *plain pendentief* of the vault which they continued to use with the cross ribbs, they began to turn *flat arches* from ribb to ribb by this means they were able to make lighter arches which with arch buttresses they could apply to larger spans, as in the presbitery of the Church of Ely etc. (BL Add MS 6762, 28r; my italics)

This text may be misleading for a modern reader. What are the "plain pendentiefs" (sic) and the "flat arches"?

– The "pendentiefs" (from the French, *pendentif*) are the webs built between the ribs; "plain" would refer to the common construction following the in-

tersecting cylindrical barrels.
- For "arches", as it has been mentioned before, Essex uses the word not only in the common sense of the plane linear arch, but also to refer to the shell of the vaults between the ribs.
- "Flat arch" refers, not necessarily to a straight arch (a platebande) but to a surbased arch, a basket arch (see Boyer (1708) under *anse de panier*, *voûte*, "flat arched vault"; also, Dubreuil (1725, 65). "Flat arch" then may also refer to vault shell between ribs, showing a basket or domical form.

I believe, then, that Essex is referring to change the simple curvature of the cylindrical barrels of the old shell webs to shells of double curvature, that is, to make the webs somehow "domical", as in Figure 23.

Essex also describes the change in the construction of these kind of vault webs, greatly differing from first cross vaults with its heavy construction of ragstones. He dates this change during the Reign of Henry III, 1216-1276. The masons built the vault webs with "flat arches turned from one rib to other with bricks or stones cut in the form of the ribs the top of which they covered with a thin coat of cement mortar which the french call Chapeau." (BL Add MS 6771, 81r)

Reduction of thickness in "domical" webs

This change of the surface curvature permits a dramatic reduction of the thickness of the shell. The plane arch or barrel vault needs a thickness which is a fraction of the span (to accomodate comfortably the thrust line); the shell of double curvature may admit even a membrane solution, a surface of thrust, in compression with "zero thickness", the actual thickness being limited only by constructive reasons. Even a very slight curvature of the ridges of what appears from the floor a typical cuatripartite vault allows this reduction of thickness. Indeed, some webs of large quadripartite vaults have very small thicknesses. For example, in Notre Dame of Paris, the thickness of the vault webs is around 14-20 cm, for a span of about 12 m; this thickness is nearly 1% of the span, the same proportion of an egg's shell. The information about the actual thickness of the vault webs even for important Romanesque or Gothic churches and cathedrals is usually lacking and sometimes contradictory —the best compilation and discussion is still in Fitchen (1961, 256–259). The height of the solid filling on the conoids or haunches of the vaults has also extraordinary importance. Also in this case precise information about this crucial parameter, the geometry of the surface of the webs, is usually lacking in most architectural studies of Romanesque or Gothic buildings. The matter of the structural behaviour of such thin shells is rather technical and the reader may refer at the best to Heyman (1995, 2012).

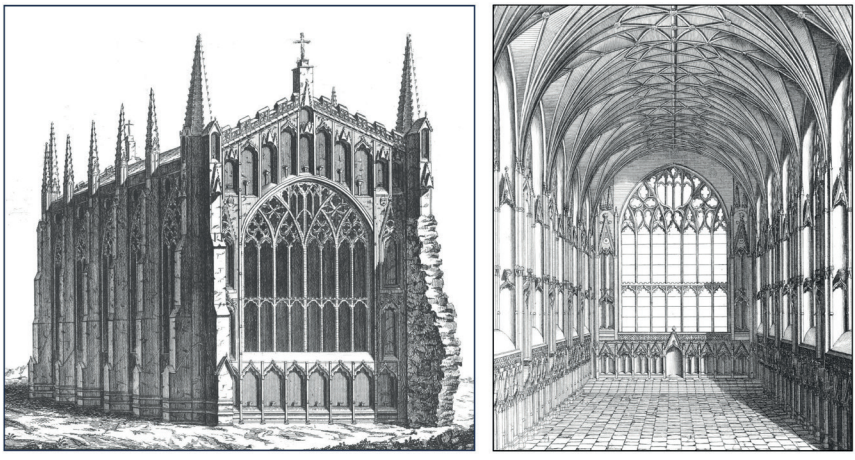


Figure 24
Lady Chapel in Ely Cathedral (1321–1329). Exterior view and interior (Bentham 1771, from Plates 41, 42).

Lierne vaults: The multiplication of ribs

The next step was to increase the number of the ribs. In this way, says Essex, they could reduce even more the thickness of the webs, further reducing the thrust of the vaults.

> When they began to multiply the number of Ribbs they altered the manner of constructing the vaults, instead of the heavy load of brick or flat stones shaped like bricks with which they constructed their vaults their method was to turn flat arches from ribb to ribb with small stones, by this means they made lighter arches which were better suited to the vaulting of the great aisles of churches. (BL Add MS 6771, 28r)

It was possible, then, to dispense whith the flying buttresses and return to the use of simple abutments attached to the wall, as in Trinity Church (now Lady Chapel) attached to Ely Cathedral (Figure 24):

> … adding more ribbs and lessening the span of the pendentiefs they were able to make those arches much thinner and lighter and capable of being supported commonly by buttresses without bows, as in the Trinity Church jointed to Ely Cathedral. (BL Add MS 6771, 28r)

Essex says that these kind of vaults with multiple ribs were used first in the time of Edward II or Edward III, that is between 1307 and 1377, but that they were inferior to that built afterwards:

> The vaultings of this sort which were first used in the time of Edward 2 or 3 were much inferior in beauty to those which were afterwards used. Though they made them very light thin and indeed sufficiently strong but they seem not to have known enough of their true forme to be able to judge what curves were necessary for forming the several parts: therefore they made their ribbs of many parts of circles all of the same curves something which made them appear *lame and disagreeable*. (BL Add MS 6771, 81v. My italics)

The vaults were "light" and "sufficiently strong" but the geometry of the ribs was somehow imperfect and the result is that the vaults appear "lame and disagreeable". Here we find a aesthetical judgement based in a technical aspect. Apparently, the curves of the ribs were not properly made. As Essex did not mention concrete examples we can only make a guess about the source of his dissatisfaction. Probably the problem was that the centres of the curves of the ribs had to be found "accidentally" not from a "principal arch" regulating their geometry.

Rib and panel vaulting

Another technical change occurred in vault construction. Essex noted that the desire to arrive at more slender and lighter structures led to another change in vault building, the so-called "rib and panel" construction, which appeared during the reign of Henry VI [1413–1422]:

> … as they changed their stile of building from the gross to the slender they were obliged to invent a sort of vaults suited to them: so that in the time of Henry the 6th when the stile of building was quite altered we find likewise another kind of vaulting composed with ribbs and pannils variously of Tracery work. (BL Add MS 6771, 81r-81v)

Essex thinks that the idea comes from wooden vaults, and cites York, Peteborough and the Lantern of Ely, but then was adopted in masonry:

> but as the art of masonry arrived at a satisfying perfection they soon ventured to construct these kind of vaults with ribbs and pannils of stone which being very thin and covered with plastering made an amazing sort of vaulting quite unknown to the antients.

Now the panels were made of single flat, thin stones, which simulated the timber boards. Thanks to this new rib and panel system and the development to of the "art of tracery", that is mastering the geometric design of all the elements, the

Gothic system reached a new level of perfection. Essex considers that this happened at the time of Henry VII [1485–1509]: "the vaults [did not reach] *to the perfection they were capable*, till the time of Henry the 7" (BL Add MS 6771, 81v. My italics).

Essex praised and wondered at the buildings of this time, the exact size of the abutments, the precision in describing the ribs, the ability to find exact sizes of all the stones, and the extreme lightness reached which allowed them to build vaults of 50 feet span and thickness of 2 inches:

> They were exact in adjusting abutments to the weight of their vaults and so extremely nice in the execution of all the parts and so very exact in describing the curves of every particular rib, and giving to every stone its proper form and that were able to form vaults fifty feet diameter the thickness of the shell between the ribs did not exceed two inches for the great exactness which was observed in describing the curves of the several ribs, the care that was taken to give every stone its true form and bearing, the amazing thickness of these vaults and the nice adjustment of the abuttments to weight and form of the vaults can never be too much admired. (BL Add MS 6771, 76r)

The dimensions refer probably to the vaults of King's College Chapel which Essex studied in great detail; however the Chapel has a span of 40 feet, the greatest of any Gothic vault in England. (The text appears in sheet of paper, written quickly, carelessly, with many crossings out and erasures, so it may be an error.) The incredible thickness of only 2 inches (5 cm) is undoubtedly from King's College. The dimension is confirmed by a contemporary of Essex, Thomas James who wrote an Account of the Chapel (Thomas, Malden 1769, 20). Mackenzie (1840, 16) quotes this dimension of 2 inches and says that he measured 4½ inches for his plates.

Essex express once and again his deep admiration of Gothic, and his superiority on the modern architecture which came later:

> Those curious structures (of the Chapels) at Westminster, Cambridge, Windsor and Ely with many others finished about that time are standing monuments, for all these, and indeed all of that age, are executed with the greatest skill and all the correctness imaginable, which shows how they excelled the generality of modern artists in the art of stereotomy. (BL Add MS 6771, 28r)

and in other part of the manuscript insists that these buildings:

> are standing testimonies; for not only these but all of that age, were executed with such extraordinary skill and correctness as is rarely to be met in any of our modern

Figure 25
View of the interior of King's College. (Engraving by H. Le Keux after a drawing by F. Mackenzie. Britton 1807a, Pl. 7)

Edifices. (BL Add MS 6771, 61v)

The peak of perfection: the vaults of King's College Chapel

But for Essex the peak of perfection was reached in the design and construction of the vaults of King's College Chapel, Figue 25. No doubt there are sentimental reasons: as a child he attended a Grammar School which was in front of the Chapel. As we have seen, the Chapel was the first Gothic building which he studied and drawn when he was only 19 years old, and in his early 30s he must have spent long hours for months on the scaffolds, measuring the turrets and pinnacles, the windows, and, in particular the vaults, preparing a book which was never published. Besides, the house were he lived, between St. Botolphs Church and Benet Street was barely one hundred metres from the Chapel (Essex 1788, xxvi). Inspecting his manuscripts and drawings about King's College Chapel there is more than academic interest, it is true passion, love and admiration for the building.

Some comments seem pertinent before discussing Essex's study of the vaults of King's College Chapel. The vaults on the Chapel are fan vaults. Fan vaults are generated by rotating one half of the principal arch about the vertical axis forming a conoid; the intersections of successive conoids produce the fan vault. There may be a central spandrel as in Figure 26 (a) where the conoids do not intersect. With an square plan an intersecting conoids the spandrel disappears, Figure 26 (b), and the intersecting conoids produce a sinusoidal curve. The vaults in King's College Chapel are of this last sort. Essex gives the first description of the geometry of this kind of vaults and explains precisely the way to obtain the curves of intersection of the conoids which produce the

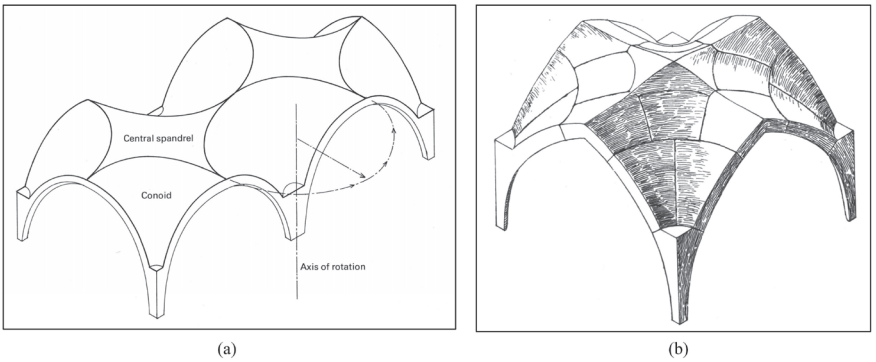


Figure 26
(a) Fan vault formed by a succession of conoids which do not intersect (Leedy 1980). (b) Fan vault of intersecting conoids (Howard 1911).

ridges of the vault. Essex study, written most probably in the 1750s during his surveying of the Chapel, predates almost a century the definitive study on the construction of fan vaults made by Robert Willis (1842). Howard (1911) wrote a long article with a classification of fan vaults. Leedy (1980) published a complete catalogue of all major fan vaults built up to 1540. Professor Heyman has studied the structural behaviour of this kind of vaults in several publications; see, for example, Heyman (1995, 75–82).

King's College Chapel was the peak of perfection of the the rib and panel vaults of the time of Henry VII, he affirms:

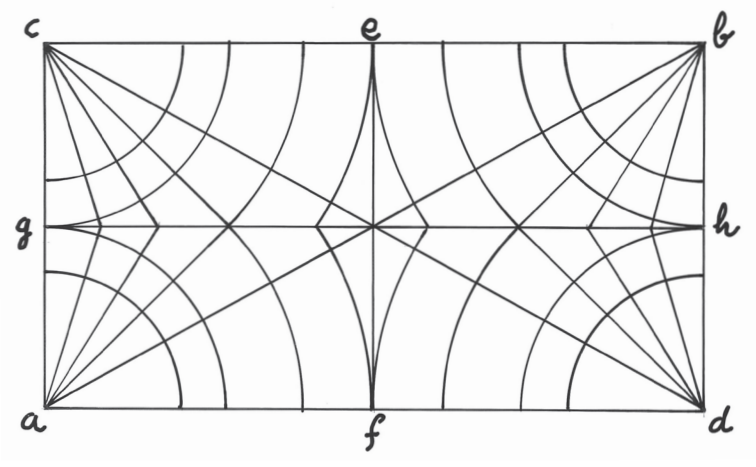


Figure 27
Essex's sketch of one bay of the vault of King's College Chapel (redrawn after BL Add MS 6771, 82r)

> amongst the variety of designes which may be seen of these sort of vaults there are few more elegant and none more simple or easy to be constructed than this in our Chapel; it is as light as could be consistent with its strength and as strong as necessary, without burthening the abuttments which are sufficiently strong to support them and yet not so heavy as to appear disagreeable. (BL Add MS 6771, 82r)

In the text that follows, along several folios, Essex concentrates in explaining the geometric generation of the vaults, and the revelation that only "three curves" are necessary to construct the vaults, and that the whole vault design derives from the "principal arch", which is the diagonal cross arch of the bay (Figure 27):

> In constructing this vault there are no more than 3 curves necessary all the rest being

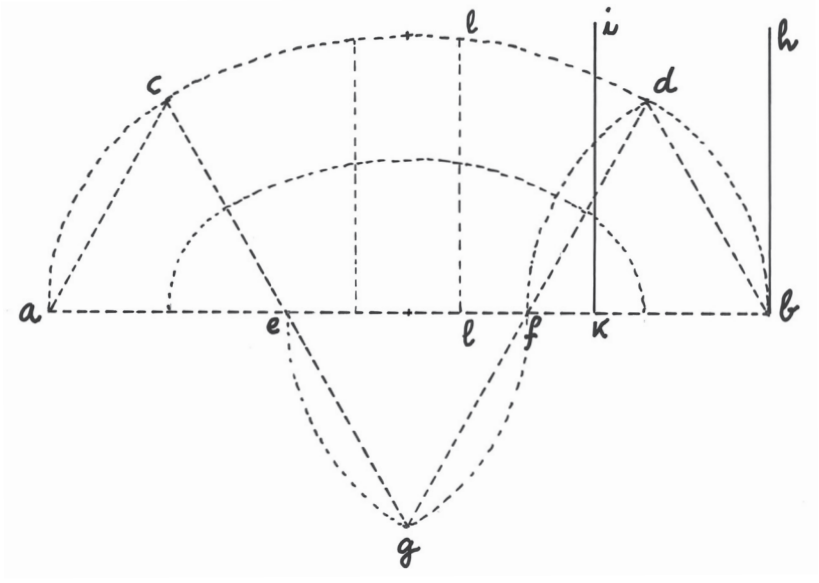


Figure 28
Tracing of the principal arch of the vault of King's College Chapel (redrawn after BL Add MS 6771, 82v)

> parts only of the same arch. The *principal arch* on which all the rest depend is that which runs from *a* to *b* and from *c* to *d* all the other ribbs are segments only of this being proportional to the length of the several radii *be* etc. The other curve is that which is formed by the intersection of this arch on the line *gh* and the curve *ef* is a part of it. (BL Add MS 6771, 82r. My italics)

Essex describes the tracing of the principal arch. He considers that it is a semi-oval of the same kind as described above, Fig. 13), the diagonal is divided in three equal parts, with the central part an equilateral triangle is formed, which defines the centres of the arches, which define the oval; the rest of the ribs are parts of this arch in proportion to the length of the respective horizontal projections (Figure 28):

> The principal arch *ab* is thus constructed having divided the line which is the base *ab* into 3 equal parts each of them describe equilateral triangles as *ace*, *bfd* and *fge* from the points *f* and *e* describe the arches *db* and *ac* and from *g* the arch *cd* which is the curve of the 2 cross ribbs of this vault, and all other ribbs are parts of this, proportioned to the lengths of their bases *be* etc. (BL Add MS 6771, 82v)

The principal arch, the diagonal or crossing arch, is not a pointed arch, remarks Essex, but the rest of the ribs are pointed, being portions of the principal arch, the tangents at the heads are not vertical. The same occurs in the arches of the great East and West windows of the Chapel and in the great transverse arch because they are also obtained opposing segments of the cross rib and also the mouldings are deduced from the principal arch:

> the arches of the windows and all the other mouldings round them are described and these are only opposing segments of the Cross ribbs they will when brought together naturaly form an angle or point as it is called in the Crowns of the arches of the east and west windows and of the Great ribbs in the vault. (BL Add MS 6771, 82v)

Afterwards, Essex discusses the construction of the curves of the ridges running N-S and E-W, *ef* and *gh* in Fig. 27, pointing out that these curves are difficult to plot, it being necessary to find a number of points and join them by a curve, either by hand or with a flexible ruler:

> The curves which cross the vaults from n[orth] to s[outh] and from e[ast] to w[est] are not so perfectly well formed as the other, owing perhaps to the difficulty of tracing them which can only be done by finding a number of points and tracing them by a steady hand or bending a thin lath to the points and marking [them?] by that.

The ridges are obtained by the intersection of the fans generated by the rotation of half the diagonal arch rotating around the vertical line *bh*, Figure 28. (The exposition is confusing and serves to demostrate the difficulties the reader may encounter in handling this kind of manuscript text.) One half the arch *acdb* rotating about the axis *ih* will produce a solid which intersecting the vertical plan over the horizontal projection of the ridge, *gh* in Fig. 27, *ik* the vertical intersection to the vertical plan *bd* in Fig. 28 (point *k* in Fig. 28 corresponds to point *h* in Fig. 27). The operation is similar to the intersection of a cone by a vertical plane which produces a hyperbola:

> This curve is thus generated if one half of the arch *bdca* be moved round the line *bh* as an axis, it will generate a solid which being cutt by a plain passing though *ik* perpendicular to the surface *hi* its section will produce the curve of the Ribb *gh* as a cone cutt by a plan ⊥ [perpendicular] to the base produced the hyperbola and in like manner another curve will be formed of the same kind by a plain cutting the solid in *ef*. (BL Add MS 6771, 82v-83r)

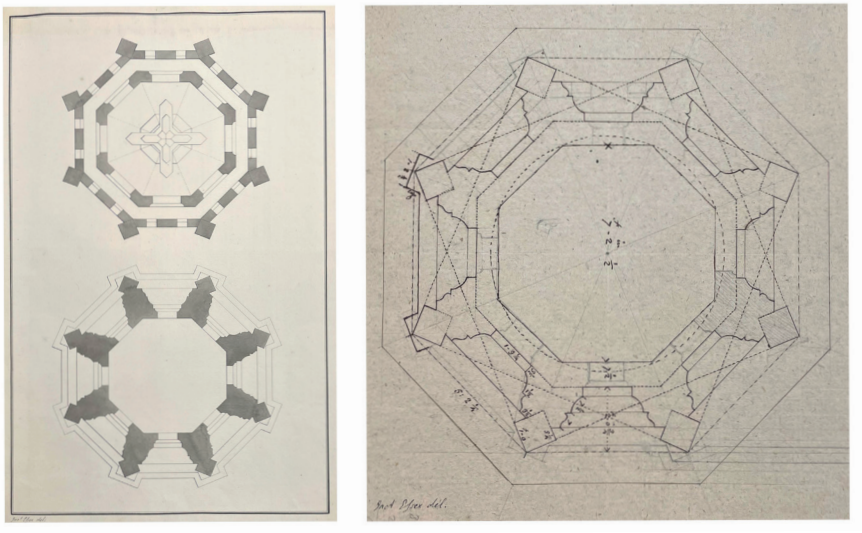


Figure 29
Tracing of the plan of the East turret. *Left*, the plate prepared for engraving. *Right*, the geometrical tracing "ad quadratum" (rotating squres). (BL Add MS 6776, 14r and 15r).

The vault is of rib and panel construction and Essex consider that all the elements have a proper dimension. The shape of the ribs is emphasised by the flatness of the panels and the ribs are "neither too large as to appear heavey nor too small to make them look weake" and the rib mouldings are also well designed "not so small as to be undistinguishable at the distance they are to be viewed from, nor so gros as not to bear the nearest inspection."

The vault survey of 1756

> In the year 1756, etc., scaffolds being erected to the highest points of the four angular towers of King's College Chapel, which were completely repaired under my inspection, I used that opportunity of taking dimensions of all the parts of them, and have made a perfect elevation, section and plans of the several parts. The like opportunities have been taken to make an exact section of the great vault, and taking all other necessary measures for describing every other part of it. I have likewise the exact measures of the east, west and side windows, the general plan of the whole building and vaulting, the finials and all the principal parts, not to be measured without scaffolding; and if any parts remain not taken, they are within reach.

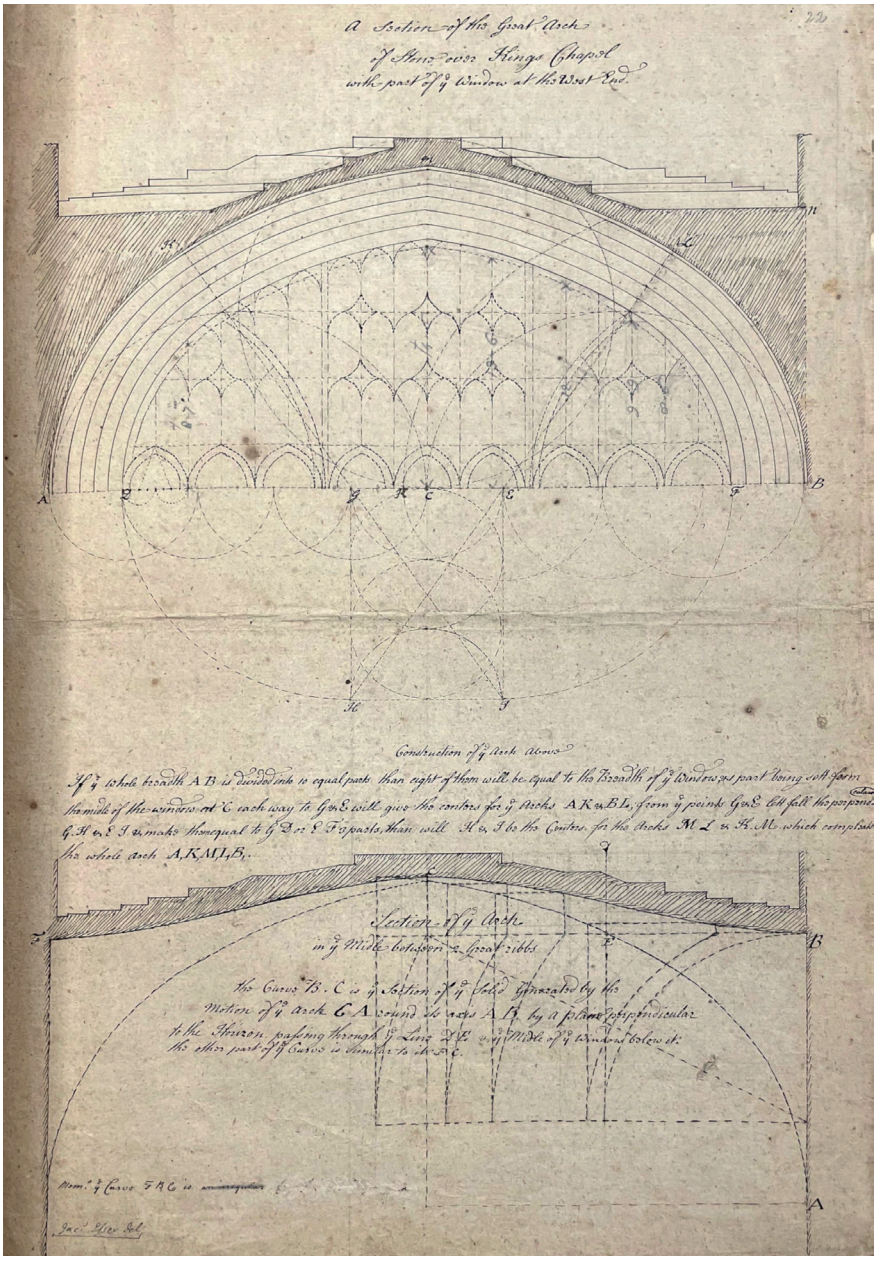


Figure 30
Great arch of the west end and section through the middle of the adjacent bay (BL Add MS 6776, 22r).

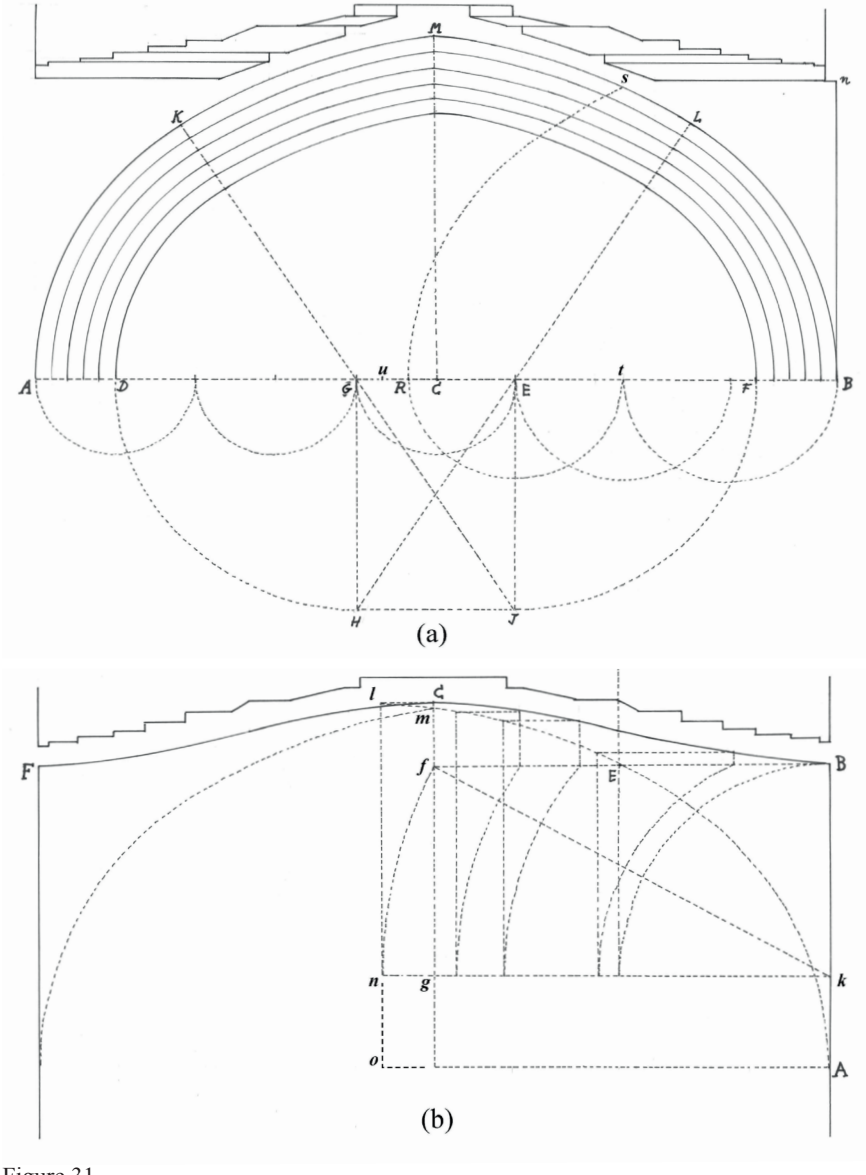


Figure 31
Tracing of the arches and transverse section of the vaults of King's College Chapel: (a) Construction of the great arch and the window at the West front; (b) Transverse section of one bay of the vault in the middle between two transverse arches. (Redrawn after BL Add MS 6776, 22r, Fig. 30 above. Handwritten capital letters correspond to those in the original; printed lower case letters have been added to assist in the explanations.)

This is the account of the works of inspection and survey made by Essex on King's College Chapel in 1756 (included in a letter from Cole to Walpole in 1771. Lewis (1937, 1, 209); quoted by Jerrold (1977, 60; see also, Chainey 1992, 43). Cole affirms in it: "Whoever hopes to give an account of the Chapel cannever hope to do it with the accuracy of Mr. Essex."

His drawings are contained in a folio, BL Add MS 6776. Some are highly finished and ready for engraving. Others form part of geometrical studies of different parts. The plates are neatly drawn.

The ones concerning the turrets are particularly interesting; besides the finished plate there are the geometrical studies which try to find the rule to trace these designs. The present author was much surprised to find both in plan and in elevation some methods of tracings with squares and triangles with an unmistakable German flavour. The tracing "ad quadratum" (rotating squares) of the plans of the East turret and the projection in one tracing of several horizontal sections at different levels is typically German late-Gothic (the literature on this topic is abundant; a classic work is Velte (1951)). We will not follow this matter but seems to connect with the possible German-England relationship mentioned before.

Coming back to the topic of this work, the vaulting, some drawings by Essex in this folio of drawings give relevant evidence of Essex's deep understanding of the construction of the fan vaults of King's College Chapel. What is of interest here is the description of the geometry of the vaults, the construction of the principal (cross) arch, the transverse arches and the Great windows, and of the wall arches. In particular folio BL Add MS 6776, 22r contains two sections N-S of the West bay, Figure 30. In the first, taken near the wall, the tracing of the great arch of the window is shown. In the second, the section has been taken my the middle of the bay and shows the exact method of drawing the ridge. The tracings has been redrawn in Figure 31.

In the upper part, Fig. 31 (a), the legend in the manuscript says "A section of the Great Arch of Stone over King's College with part of the Window at the West End." Below Essex explains the tracing. The intrados of the vault is a pointed arch of four centres. *G*, *E*, *H*, *J*. The diameter *AB* is divided into 10 parts; one of them is the thickness of the window arch. Points *G* and *E* are the two centres on the diameter. To obtain the other two vertical lines are drawn and the centres *H* and *J* are on these lines below the diameter at a distance of two parts. The rectangle *GEJH* formed by the centres has a proportion of 3:2. The inclination of the diagonals with the horizontal is not 60° as in the "common semi-oval" but 56.3° (this contradicts the construction of Fig. 28 above).

Now the curve of the intrados of the vault *AKMLB* can be drawn. The profile of half the diagonal arch can be obtained prolonging the arch *LM* until the verti-

cal *u*, being *uB* half the diagonal of the bay (as we shall see *Gu* = *uR* = *RC*). And this is the arch *Aeml* in Figure 31 (b). In Figure 31 (a) the small arch is also drawn. Dividing the *EB* into three parts, point *t* and *F*, and making *RE* = *Et*, *RB* is the diameter of the small arch on the wall. This arch is also composed of two segments of the principal arch, and is drawn as arch *RsB*. Essex do not mention the word "principal" but the cross rib is the principal arch of this vault, containing the curves of the rest of the ribs of the vault.

> Construction of the arch above
>
> If the whole breadth *AB* is divided into 10 equal parts then eight of them will be equal to the breadth of the window, which part being sett from the middle of the window at *C* each way to *G* & *E* will give the centers for the Arcks *AK* & *BL*, from the points *G* & *E* lett fall the perpendiculars *GH* & *EJ* & make them equal to *GD* or *EF* 3 parts, then will *H* & *J* be the centers for the Arks *ML* & *KM* which complete the whole arch *A*,*K*,*M*,*L*,*B*.

In Figure 31 (b) is the tracing of the "Section of the Arch in the Midle between 2 Great ribbs". There it is the curve *FCB*, the ridge line produced by the intersection of the conoids. In a short paragraph incrusted in the drawing Essex explains the way to trace the curve of intersection of the two conoids:

> the Curve *B.C* is the Section of the Solid Generated by the motion of the arck *CA* round its axis *AB*. by a plaine perpendicular to the Horizon passing through the line *DE* & the Midle of the window below it. the other part of the Curve is similar to it *FC*.

The text repeats almost word by word the one studied above. But here the geometrical construction is given, though without any explanation. The construction is correct and it is the first time, as far as I know, that the intersection of two conoids is given. Essex construction predates by ninety years the one given by Robert Willis (1842, 48).

The half diagonal arch *lA* (projected horizontally as *fk*) rotating around a vertical axis passing through *k* generates a conoid, which intersection with the vertical plan passing through *fB* will produce the curve *CP*. This curve is obtained by points. It is easy to see that the circle produced by a point *p* on the arch *lA* will intersect the vertical plan at point *P* (the projection of this circle on the plan is the arc *p'p"*). The point *l* intersects the vertical plana in point *C*; point *E* corresponds to the cusp of the pointed arch in the wall.

Principal arch construction

The main characteristic of the construction of the vault is that all the ribs are segments of the principal arch, the cross rib. It is remarkable that the transverse arch and the wall arch are "regular", that is can be constructed dividing their respective diameters in a certain number of parts. This property is hidden in Essex drawings.

That this is possible is due to a certain proportion of the rectangle of the bay. In

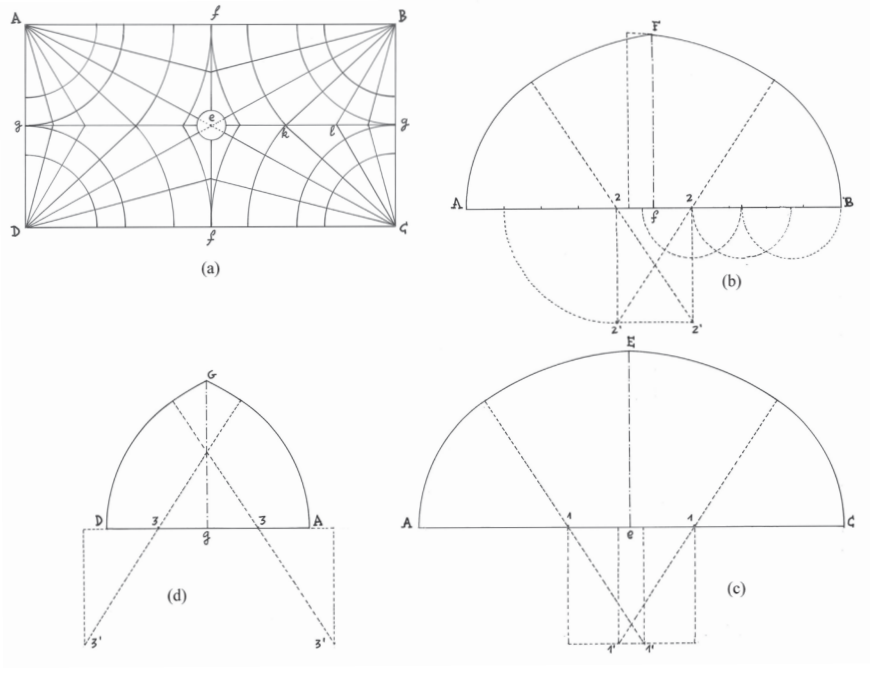


Figure 32
Bay of the vault of the King's College Chapel: (a) plan; (b) transverse arch; (c) cross arch; (d) wall arch.

one of his tracings the exact dimension of a quarter of bay are given (BL Add MS 6776, 23r): 20 feet 11 inches by 11 feet 1 ½ inches. This distances are exactly in the proportion 15:8. The diagonal of a rectangle 15 by 8 is 17. (The triple 17, 15, 8 is "pythagorean" $17^2 = 15^2 + 8^2$.) It is precisely this singular proportion of the plan which permits that the transverse arch and the wall arch can be constructed in a "regular" way, dividing their diameters in equal parts. This triple is convenient as it gives a rectangle proportion of 15/8, nearly 2.

In Figure 32 the three main arches has been drawn. If we consider a small module $m = AB/10$, then, in the transverse arch (b) the two centres 2 are separat-

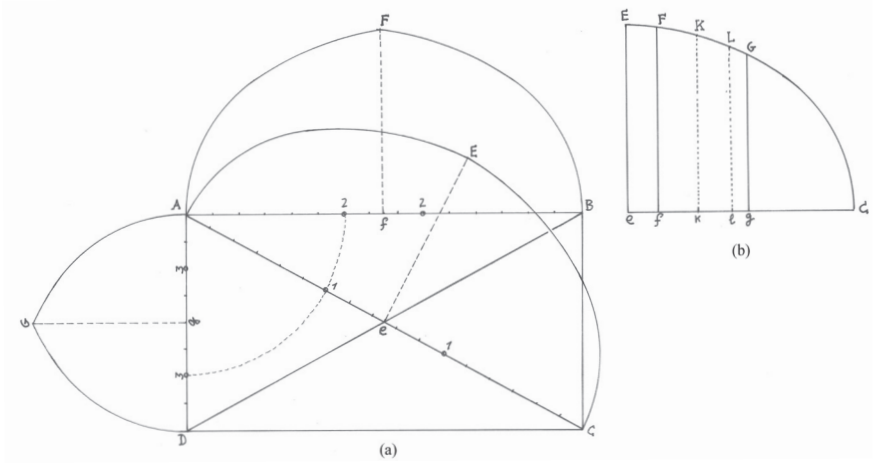


Figure 33
Hypothetical reconstruction for the origin of the tracing of Figs. 30 and 31

ed *m* from the centre of diameter, in the cross arch (c) the centre are separated 1½*m* from the middle, and in the wall arch (d) 2*m*. All the rest of the centres, two for each arch, are below at a distance 3*m*. The proportion of the triangles which define the slope of the radii is 3:2.

In Figure 33 (a) the plan has been drawn with the rotated arches. In two sides of the rectangle and in the diagonal has been marked the units 8, 15, 17. On the diagonal the two centres are separated into 3 units. Drawing a quarter of a circle taking one of the corners of the rectangle as the centre the centres on the other two arches are easily obtained. All three arches are pointed. The height of the cross arch is 6.9 units, of the transverse arch 6.81 and of the wall arch 5.75. In a longitudinal section given in BL Ass MS 6776, 22v Essex draws the extrados of the ridge horizontal but the intrados slightly curved and remarks this curve "is of the same kind as that on the contrary section."

In figure 33 (b) the main arch containing the rest of the ribs of the vault has been drawn; its base is *eC* and its height *eE*. The wall arch has a base *gC* and a height *gG*. The bases and heights of the ribs *kC* and *lC*, Fig. 31 (a), have been drawn in figure 31 (a). Essex does not use this mode of representation (at least I have not seen it in the manuscripts inspected) but it is undoubtedly very convenient (and was the one used in German late-Gothic). The medieval mason, who has first drawn the plan, has in one single tracing all the relevant geometrical parameters.

The use of the principal arch method is straightforward in a fan vault

where, by definition, all the ribs have the same curvature. The main point is that from the principal arch the rest of the arches and ribs are deduced producing "regular" arches, that is those which geometry is generated dividing the diameters in a certain number of equal parts. This is what Essex was looking for as is evident from the examples in Figs. 20 and 21 above, and from the dozens of drawings on "regular" arches in the manuscripts consulted (see, for example, for pointed surbased arches of four centres, BL Add MS 6762, 99–107; 6771, 54r–73r).

The Art of Tracery

Essex considered that the perfection of Gothic was achieved at the time of Henry VII through the "Art of Tracery". In a well traced building all the elements are related to the whole and the whole to any single element. This was achieved in the design of his most admired Gothic building, the King's College Chapel.

> … vaults were not then brought to their greatest perfection, before this stile of building was in the meridian of its glory, the architects had learned *the art of Tracery*, and by multiplying the ribs of their vaults, and disposing them into variety of forms, they could make the pendentifs with thin flat stones, and forme the curve of every rib exactly to answer their arches and the plan of the vault, in whatever figure they pleased to dispose it … [and] were executed with such extraordinary skill and correctness as is rarely to be met in any of our modern Edifices. (6771, 61r–61v. My italics)

This comparison between Gothic and contemporary (modern) buildings, in which the superiority of the former is clearly stated, appears in many places in Essex's writings, and he found no excuse for the incompetence shown in the latter:

> … in the present age the Theory if Architecture is so far from being perfect that absurdities … are daily committed in the Execution of the works of modern architects who are the more inexcusable as the opportunities of improving the theory of their art are much greater than ever were in any precedent age geometry and every branch of Mathematical knowledge on which it is founded being brought to greater perfection. (6771, 27v-28r)

It appears that he was not alone in this appreciation and such an eminent architect as Christopher Wren seems to have shared it. Horace Walpole, in his *Anecdotes on painting in England* (1762, 108) says that "There is a tradition that Sir Christopher Wren went once a year to survey the roof of the chapel of King's college, and said that if any man would show him where to place the first stone,

he would engage to build such another."

This admiration on the ability of the Gothic masters to achieve an harmony between the whole and its parts, probably has its roots in Essex study of Vitruvius who in his Book II, Chap. 2, where he discuss the order and Symmetry in Architecture, "the correspondence of each given detail among the separate details to the form of the design as a whole" With reference to this last Vitruvian sentence, Essex finish his long article on masonry construction in England with a paragraph that sounds like a manifesto:

> For the Gothic, like the Grecian, architecture has its different orders or modes, and every order its peculiar members by which it may be distinguished from the rest; and as these are regulated by just proportions founded upon geometrical principles, as capable of demonstration as those of the Greek or Roman we may judge of the whole from a part, with as much certainty as we may know the extent of a Roman temple from the length of a triglyph. (Essex 1777, 108–109)

That the classic ideals of proportion, symmetry, etc., influenced Gothic design has been demonstrated beyond doubt; see, for example, Frankl (1960, 86–110) and Heyman (1992).

This orderly relationship from the whole to its parts, from the building to its vaults, arches and buttresses was beautifully expressed by Essex in the following paragraphs intended as an introduction to his, never competed, History of Gothic Architecture (BL Add MS 6771, 200; quoted by Jerrold (1977, 62)).

First, Essex points out the ignorance and prejudiced against Gothic, which could be overcome by careful inspection of them:

> There is no Stile of Architecture so little observed and less understood than that which we call Gothic though it is not so barbarous and inelegant as is generally supposed, neither do the works of the Age we call Gothic deserve so much ridicule as the present age are pleased to bestow upon them; for, whoever considers their works with attention will find many of them judiciously designed and admirably executed …

Then, Essex asks himself about the sources of the pleasure that these works produce in the spectator:

> But if those Buildings afford any pleasure to a curious Spectator, or instruction to the Studious Architect, surely it would deserve the attention of the Curious in General to endeavour to investigate the cause of that pleasure we find in viewing those venerable buildings

and stressed that this investigation requires a careful study, measuring its parts and ascertaining the relationship among them:

> But this cannot be done upon a cursory view of them, some time must be spent in measuring their parts, comparing them with each other, and ascertaining the proportion they bear among themselves; by thus observing the relation which the parts have one to another and to the whole Building we may trace out the Theory of their art in designing.

The skill shown in these works, the bold manner in which the masses are supported on slender pillars, the appearance of lightness produced by the vaults, all this deserves great attention:

> Nothing can be more fully contrived than many of their vaulted roofs & stone soffites, nothing more bold and surprising that the manner of supporting such masses of stone upon such seemingly slender pillars, nor can anything be made to appear lighter and more elegant than many of those vaults themselves.

But a deep understanding of the Principles, why these structures are so strong despite appearing so light, can only be obtained by an accurate measurement of their parts and a thorough study of their construction:

> … But by what Principles of Architecture these masses are supported and by what contrivance they are made strong while they appear so light and airey is not easily conceived nor can be well understood but by an exact survey of the several parts and a critical examination of their mechanical construction.

Conclusion: Outline of Essex theory on Gothic vaulting

Essex developed the first rational theory of gothic vaults and arches. Ignoring the aprioristic, romantic theories of his time he concentrates in the study of the scarce documents and the existing buildings. All through his life he inspected, measured and surveyed a great number of churches and cathedrals. For Essex, first came the cross vault and then the pointed arch. The cross vault is an evolution of the Roman groin vault. He dates the first groin vaults in Saxon England into the 10th Century. He does not cite any concrete example, but it is a reasonable hypothesis, considering the permanence of Roman masonry construction, which he studied in detail.

The first remaining groin vaults are Norman and there is even today a dis-

cussion of how possibly a lost constructive tradition was resuscitated. (Essex discards the hypothesis of a foreign Saracenic origin, first because of the dates of the Crusades; but probably the source of his skepticism (maybe unconscious to him) was that, as an experienced builder, he knew that the transmission of constructive techniques is much more than bringing some impressions or drawings.)

The first innovation was the introduction of heavy transverse arches, breaking the continuity of Roman groin vaults. These first vaults were small and confined to crypts, porticos or the lateral naves of three-aisle churches. The transverse arches were made of carved stones or of ragstones. The vault itself was built with rubble masonry and plenty of mortar. The vaults were, then, very heavy and needed a complete formwork to be erected. To support this formwork a strong centering was needed.

Essex hyothesises that the introduction of diagonal or cross arches originated in the desire to reduce this enormous expense of wood. The cross arch can be built in much lighter centering. Once completed both cross arches they acted as centering for the construction of the webs of the vaults and the centering could be removed immediately after the vault was finished. There was economy of material and of time. Not only this, the cross arches actually *carry* the weight of the vault. Essex's hypothesis was completely original. It was another 100 years before Viollet-le-Duc began to identify the cross arches *cintres permanents* (permanent centering) and considered the ribs as carrying the whole weight of the vaults. These ideas, then, were accepted by successive generations of authors, until today. (Huerta 2009)

However, the construction of the diagonal arches posed a problem: the geometry of the arch had to be decided in advance. The masons needed to trace the arch profile (in the floor or in a wall) and from this real size drawing to fabricate the templates to cut the stones. The carpenters also needed to cut the curved timber elements to fabricate the arch centering. If the perimeter arches were semicircular the groin is an ellipse. The construction of the groin was not a problem, as it is produced "naturally" prolonging the boards of the formwork. Now it was necessary to define geometrically the curve before actual construction. Essex supposes that the masons used a semi-oval to approximate to the ellipse. Oval construction had been known since Antiquity and the tracing of an oval is very easy. Here we find another observation that was then completely new and that it has been ignored by modern scholars.

The height of the "common semi-oval" is similar to the ellipse but there is a difference of height with respect to semicircular arches. If the Roman rule of perfect cylinders with horizontal generatrices is applied, then, prolonging the boards over the cross arches they pass above the semicircular extrados of the perimeter

arches. To adjust this difference Essex propose a curious theory, again completely original, but again with sound constructive basis. The masons, who have already traced the diagonal arch, "cut" to segments of it and joined them to produce a "pointed arch". The same templates and carved wood serve to build this arch. The resulting arch is a little pointed and this, Essex says, coincides with the fact that the first pointed arches were a little pointed. Essex made many drawings explaining this theory but do not cite (at least in the manuscripts consulted) any real example. The resulting arch has a semicircular intrados and a pointed extrados. This makes it difficult to introduce moulures in the section of the arch, and the only solution, after Essex, was to make the intrados concentric with the extrados, forming a truly pointed arch.

This hypothesis of the origin of pointed arches may seem too complicated and probably many readers will agree with Tyson, a contemporary antiquarian, who said "is too refined to bear talking about." Is this really so? In fact, Essex is addressing real constructive problems and looking for a practical solution. The difference between Essex and his antiquarian friends (Walpole, Cole, Gough, etc.) is that he knew very well how difficult is to build a vault. We should keep in mind Rodrigo Gil de Hontañón's warning (Rodrigo Gil was the most important late-Gothic architect in 16th Century Spain). Rodrigo, before he tried to explain the construction of a Gothic vault (the only surviving description of a late-Gothic master, ca. 1550) cautions that "these things may be difficult to understand if one lacks experience and practice, or if one is not a stone mason, or has never been present at the closing of a rib vault."

Once the pointed arch was "invented" (or rather, its possibilities in vault construction were discovered) it was soon evident the facility of using it to adapt the heights of the different arches of the cross vault. The masons also discover the rule to trace a pointed arch for any given diameter and height and began to simplify its construction recurring to "regular" pointed arches, which centres are obtained dividing the diameter in equal parts.) Essex knew that there were other methods, previous to the cross vaults, to solve the problem of adjusting the height of semicircular arches: either the centre of the arch could be raised, forming a horseshoe arch, or the springings prolonged vertically to stilt the arch. Once the pointed arch was in use, this was another solution, and Essex remarks that in some cathedrals a series of stilted and pointed arches can be seen in the same wall. The ease of construction, lightness and flexibility of application of pointed arches swept semi-circular arches out of the picture.

The main point, the most original and relevant part of Essex theory is that he considers that the pointed arch is a consequence of the cross vault and not the re-

verse, which is today the commonly accepted theory.

I believe that the long quotations above of Essex manuscripts leave this matter pretty clear. However, Thomas Kerrich, who in 1809 (publ. 1812) exposed part of Essex theory to the Society of Antiquaries "forgot" to mention any of the above theories —probably his lack of constructive experience and knowledge, precluded his understanding, and he omitted them. Kerrich concentrated of the role of pointed arch in adjusting the heights if the ribs. Two years after, in 1811 (publ. 1814) Saunders, who was probably one of the listeners to Kerrich's exposition, published his "Observations on the Origin of Gothic Architecture" in which this role of the pointed arch was its principal characteristic. Saunders do not cite Kerrich or Essex and the origin of this theory was afterwards attributed to Saunders.

To Paul Frankl, author of the most complete exposition of the evolution of the theories about Gothic, Saunders "made an essential contribution to the deeper understanding of Gothic vault construction" (Frankl 1960, 500) and he quoted Saunders in his discussion of the topic. Saunders has been recognised in modern scholarship for a theory which is not his own. Only Frankl comments that though "it would seem that Saunders was the first to publish an explanation of the pointed arch in ribbed vaults as the result of spanning different widths, he does not appear to have been the first man to acquire this insight" and cites Essex, quoting Stewart (1950). The next of the discussion on this function of the pointed arch can be followed in Frankl's book.

The cross ribbed vaults were still heavy and of small dimensions. To build the great high vaults of the central aisles it was necessary to reduce their weight and, thrust. Another change was needed. Essex observes that the webs between the ribs changed: instead of having a ruled surface defined by the wooden boards of the formwork the medieval builders began to construct surbased basket arches ("flat arches") from rib to rib. The web surfaces acquire double curvature, and this new form permitted the dramatic reduction of the thickness of the webs and as a consequence, the thrust of the vaults. Viollet-le-Duc studied how to construct these thin webs between the ribs (*remplissages*) but apparently he was unaware of the great change which led from thick small webs of single curvature to thin large ones of double curvature. Later authors, in general, have followed Viollet-le-Duc's ideas —expressed with great force and an enormous display of wonderful drawings.

The next step was to multiply the number of ribs reducing the size and thickness of the webs between them. A new form of vaults originated: the rib and panel vault. Now, Essex has to "coordinate" the geometries of the different ribs. He says that in medieval vaults there is a "principal arch" from which all the rest of

ribs are produced. The idea had both practical and aesthetical consequences. From practical point of view, this idea would make construction simpler and cheaper; it was possible to use a single module for all the elements, and masons and carpenters could work with a limited set of curvatures. From a aesthetical point of view, the relation of the whole to the parts would produce Vitruvian "symmetry".

Then, we arrive to the last step in the evolution of Gothic, the development of the "Art of Tracery", the precise geometrical handling of all the elements of the vault or the building. The combined used of the ideas of "regular" and "principal arches" permitted the development of these "curious" vaults, built at the time of Henry VII, which to Essex saw as the peak of perfection, notably the vaults of King's College Chapel.

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Bodleian Library

Gough Gen. Top. 46 Correspondence with Richard Gough (ff. 139-261)

Cambridge City Archives

James Essex Estate and Personal papers

Cambridge University Library

MS Add 9463 Account book 1769-76

EDC 4/5/19 Agreement of 12 July 1769 between Bishop Mawson and James Pearson.

EDC 4/5/54 Agreement of 25 November 1768 signed by the Dean and Chapter of Ely.

British Library

BL ADD MS 5810 Sketch of part of Cambridge in the reign of Henry III (p.233, see also 6763 f.3)

BL ADD MS 5842 Survey of Lincoln Cathedral (p.333) Correspondence with William Cole (p.344); Surveys of Ely with Letter to Dean and Chapter, 1757, 1759 (p.345)

BL ADD MS 5845 Correspondence with William Cole (p.14)

BL ADD MS 5846 Observations on the site of the monastery of Denney 1773 (p.83, see also 6761.f.9; 6772.5f.179)

BL ADD MS 5848 Observations on the Old Chapel of Sidney College with plan 1776 (p.93, see also 6716 f.1)

BL ADD MS 5855 Observations on the origins of Round Churches with comments by William Cole and various correspondence (pp.315,329, 333)

BL ADD MS 5864 Correspondence with William Cole (f.294)

BL ADD MS 5992 Letter to Essex from E.Hawtrey to Essex (f.211)

BL ADD MS 5993 Letter to Essex from G.Stevens to Essex (f.115)

BL ADD MS 6400 Letter to Essex from T. Bentham to Essex (f.130)

BL ADD MS 6760 Various pieces of writing on Masons and Freemasonry and manuscript copies of "Remarks upon Brick and Stone buildings in England" *Archaeologia*, IV. 73. (See also ADD MS 6761 f. 7) and "Observations on Croyland Abbey and Bridge", by James Essex FSA (printed in the Bibliotheca Topograph Brit No. 22) and notes on the building of King Solomon's Temple, bound in Quarto volume (83ff)

BL ADD MS 6761 Various pieces of writing relating to the history of Cambridge and Grantchester, and Lincoln Cathedral, bound in quarto volume (108ff.)

BL ADD MS 6762 Quarto bound volume (69ff.) containing various pieces of writing relating to the decline of

Architecture in Italy after the age of Augustus; art in England, and its division into various styles; outlines for an intended history of Gothic architecture; remarks with figures on columns; pointed arches, Gothic windows: Gothic niches and buttresses; Moorish buildings in Spain; "a perspective" of architecture; and some extracts from Whitaker's History of Manchester

BL ADD MS 6763 Quarto bound volume (63ff.) containing various pieces of writing relating to Lincoln Cathedral; the timber bridge at Rochester; the Round Church in Cambridge; the Priory of St. Giles at Cambridge; the Hospital of St. Johns, Cambridge, and its chapel; observations upon the Roman Stations, dikes, roads in the vicinity of Cambridge and the Roman origin of Stourbridge Fair and receipts for the "ltrue making of colours for glass" by Walter Gidde, 1616.

BL ADD MS 6764 Quarto bound volume (18ff.) ground plan and rough draft of a "History of the Benedictine Monastery of Ely or Conventual Church of Ely by James Essex F.S.A"

BL ADD MS 6765 Quarto bound volume (82ff.) "Introduction to the Origin of Gothic Architecture", by James Essex, F.S.A illustrated by ground plans of various churches

BL ADD MS 6766 Quarto bound volume (7ff.) Brief observations upon the progressive improvement of the early Christian places of worship, accompanied with elevations of a Temple at Paestum, the Temple of Fortuna Virilis, the Church of the Nativity, the Vatican and Ely Convent

BL ADD MS 6767 Quarto bound volume (58ff.) containing various pieces of writing including
"The Antiquities of Cambridge by James Essex, F.S.A."; copies of the inscriptions on the bells of St. Benedict's and St. Bolotophs Churches Cambridge; drawings of the South Side of the Chapel in Barnwell field;
notes concerning Barnwell Church, Little St. Mary's Church and St. Edward's Church Cambridge; inscriptions on the Bells of Kings College Cambridge and
notes of a tour in Nottinghamshire, Derbyshire, Staffordshire, Warwickshire Oxfordshire, Hampshire, the Isle of Wight, Wiltshire, Gloucestershire and Wales in the year 1766.

BL ADD MS 6768 Quarto bound volume (305ff.) containing notes and sketches titled "Miscellanies, Vol. I." including various "observations upon Order, Variety, Symmetry, and Surprise as exemplified in architecture; an ancient door in little Paxton church; note from Borlace, concerning Druidical structures; extract from an agreement for building the steeple of Walberswick Church; sketches of Dunwich Church; Ellsley Church; Ely Conventual Church; remains of Fortification of Stansted in Essex; the castle at Bishop Stortford; Birchanger Church; Lincoln Cathedral; St Mary's Church, Lincoln; the Roman Gate at Lincoln; Bungay Church, Suffolk (with remarks about round towers); Cathedral and Castle Norwich; Priory of St. Bolotoph and Castle at Colchester; St. Bartholomew Church Smithfield; Borlace on Norman Architecture; Abingdon Church and Hinxton; St. Nicholas, Leicester and Stuntney; design for a Bell tower for Kings College Cambridge; Stapleford Church; Hadstock Church; St. Peter's Cambridge; The City of Granta with ground plan; the hill and fort at Ely; Islop Church near Thrapstow; St. Sepulchre's and St Peter's at Northampton; St. Peter's and Christ Church at Oxford; St. Albans; Ancaster County Lincoln; Southwell; the Castle and vaults at Nottingham; niches in the palace gate and rthe cloister door at Peterborough; Lincoln cathedral's windows; the old rood at Ely; the font at Luton church; a list of Churches in Cambridgeshire, with the supposed dates of their erection; an extract from Grelot's Voyage de Constantinople concerning the Church of St. Sophia; notes upon the different styles of Gothic Architecture; an Extract from Dr. Stukeley's Account of Stonehenge; Prices of repairs done to the Gaol and workhouse at Cambridge; bills of Expenses during journeys; extracts from the proceedings of the Consistory Court, Cambridge, May 1665 and March 1664 with an index by Thomas Kerrich.

BL ADD MS 6769 Duodecimo bound volume (355pp.) notes and sketches titled "Miscellanies, Vol. II." including notes on Westminster, Rochester, Temple Church and Canterbury Cathedral; some observations on niches; a chronological table of the Kings of England, with notes relating to the changes of architectures and the buildings erected in their reigns; Norman and Early English arches; notes on the formation of the arches in the vault of the presbytery and Parish Church of Ely; chronological notes concerning the erection of the different parts of Lincoln Cathedral and measurements; remarks on the different styles of Roman and Gothic Architecture; extracts from the "X Scriptores" concerning the erection of the churches of St Paul's London, Winchester, and Aix; remarks on mouldings and bases; a survey of repairs for Lincoln Cathedral; architectural details of Ely Cathedral; Architecture in Northamptonshire, from Phil. Trans. 116 and remarks on it; extracts from Leland's Collectanea; Bell Tower of the Church of the Sepulchre, Jerusalem; notes on the Churches of Yatterdon, Stanford-Dingley, Deanty and Shaw from the Biblioth. Topographia Vol. 16; extracts from Leland's Itinerary relating to temple Bruern Church, Glastonbury Abbey, the Castles of Borow and Sudeley, the abbies of Godstow, St. Mary's Leicester and Gloucester, the buriaal of Lady Tupell at Shottsbrook, Alesbury Parish Church, and Boltow Castle, Canterbury, Hereford, Pershore, Evesham, the Jews at Lincoln, burning of Canterbury and Southwark; a survey of the Cathedral Church of Ely and Trinity Church

dating from July 1757 and various other notes and payments.

BL ADD MS 6770 Duodecimo bound volume (171pp.) notes and sketches titled "Miscellanies, Vol. III." including notes on arches in the abbey of Oronsay and Exeter Castle; Salisbury Cathedral; extracts from the Itinerary of William of Worcester relating to Romsey Church, Salisbury Cathedral , Tarent Abbey and Exeter Cathedral; door in the house of Curio at Egypt (from Pocock's Description of the East); extracts from Cam History and Baker's MSS; observations on glazed windows in churches; "A Chronology of Architectures and Architects, by James Essex, F.S.A"; a similar chronology from the time of Cain AM 500 to Iostratus, AM 3715; Saxon and Norman Architectural Ornament

BL ADD MS 6771 Quarto bound volume (373ff.) containing Mr. Essex's notes and memoranda for his works on the History of Gothic Architecture and on ancient architecture; pointed arches and vaultings; windows and glass; doors; columns and pillars; notes on Temples with plans of ancient Christian churches; sketches of temples; notes on Masons and masonry; chronological notes relative to the erection of ancient temples and churches; letters from Horace Wapole to the Rev. Will Coles of Milton and Mr. Tyson; letters from Mr. Cole to Mr. Essex; Proposals for "A Course of Gothic Architecture by J. H. Mintz"; letter from the Rev. Will Gostling to Mr. Essex and from Mr. Essex to Mr. Gostling; various works relating to architecture; miscellaneous notes on Cathedral of St. Alban's and Ely, the Palace of Doclesian and the Temple of Jupiter, St. Giles' Church Cambridge, the Druidical Hill at Ely; excerpts from the Episcopal Registers of Ely relating to Cambridgeshire Churches copied from Bakers' MSS in the Public Library; extracts from Warton's Observations on Spencer and History of English Poetry, illustrative of Architecture; miscellaneous papers & notes relative to ancient architecture in general and the History of Architecture, particularly the Tabernacle and Temples of the Egyptians, and Greeks with sketches and plans.

BL ADD MS 6772 Quarto bound volume (283ff) containing a similar collection of Essex's Architectural Works: collection of rough plans, elevations and sections with measurements and architectural calculations relating to King's College chapel; misc papers on Gothic Architecture, featuring St. Albans, Peterborough, Croyland Abbey, Rochester old Bridge and the bridge at Croyland; drafts of letters between Essex to Gough; a glossary of words and technical terms used from in architecture from various sources; various papers relating chiefly to buildings in Cambridge including a chronological list of the erection of churches in Cambridgeshire; a History of Denny Abbey; collections of papers consisting relating to Ely and Lincoln Cathedrals

BL ADD MS 6773 Quarto bound volume (75pp) containing an essay on perspective

[*note on missing numbers in this sequence: ADD MSS 6774 and 6775 are papers by Thomas Kerrich, not directly related to Essex*]

BL Add MS 6776 Quarto bound volume (96ff) architectural drawings, plans and sketches of Corpus Christi College, Cambridge; Kings College Chapel, Cambridge, finished drawings for an intended history of architecture; Plan and longitudinal section of the ruins of the Conventual Church of Ely; plan and section of the Church at Croyland; drawings with measurements of Gothic Architecture; drawings of bridges and various designs of buildings.

BL ADD MS 42569 Architectural drawings of buildings (mostly Cambridge) before 1738-1766. (8 ff.)

Gonville and Caius College, Cambridge

MS 616 Short account of meeting with Essex about the scheme for the end of the Senate House, 1766

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